NORTHEASTERN FOREST EXPERIMENT STATION

ANNUAL REPORT

FOR 1941

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ANNUAL REPORT

of the

NORTHEASTERN FOREST EXPERIMENT STATION

1941

HIGHLIGHTS OF RESEARCH RESULTS FOR 1941

Forest Economics

1. The fallacy of cutting small trees except for stand improvement was indicated anew by stumpage appraisals involving 550 acres of merchantable hardwoods in Otsego County, New York. The value of timber if cut to a ten inch diameter limit was 6% less than if cut to a 14" limit. On the other hand, the timber 16" and over is worth 99% of the value of the timber 14" and over. Cutting to an 18" diameter limit would yield 87% of the stumpage value of the entire lot and yet would conserve a growing stock involving 60% of the number of trees over 14" in diameter.

2. Net returns from woodlands of 99 farmers participating in the program of the Otsego Forest Products Cooperative Association constituted 15% of the total net cash income from all farm enterprises.

3. Experience with the forest cooperative enterprise at Cooperstown, New York, checked by information from other cooperative ventures, indicates that the supplying of a fair market, the furnishing of an adequate timber inventory and the actual marking of timber for cutting will not assure good forestry practice by farm woodland owners. Basic obstacles are low income status of owners, lack of credit and psychological traits resulting from a surrender of woodland marketing control to timber operators during the past 50 years. Where economic status is satisfactory and psychological obstacles have been overcome, farmers can be interested in forest management as a regular activity.

4. Markets for forest products improved rapidly during 1941. Army demands for construction material resulted in price increases for native softwoods. More significant, however, was the increased demand for low grade hardwoods. Items which heretofore required processing to the form of small dimension stock now move in the original piece at good prices. This condition will undoubtedly have a marked effect on the small dimension stock business. It is generally recognized that in this field prices in the past have been inadequate and that many items have been prepared at unprofitable levels in order to move the rough lumber. With better prices trees too small for lumber may be utilized for small dimension stock. Properly controlled, this may open the way for much forest improvement.

5. In northeastern New York state there are seven measures of log volume in common use yet there is a relatively small spread between the prices paid under the different units when they are converted into comparable prices on a standard basis. The conclusion, therefore, is that both buyers and sellers would be saved a lot of confusion if one rule were adopted as standard throughout the region.

Products

1. Specially designed portable charcoal kilns of one and four cord capacity which are simple to erect and operate give yields of 35 to 40 bushels of good charcoal per cord of Connecticut mixed hardwood.

2. Hogged wood for burning in furnaces can be produced for less than one dollar per unit of 200 cubic feet if equipment is efficiently placed. One stacked cord of 4' wood will yield 200 cubic feet of hogged wood.

3. The time of seasoning of hardwood cordwood can be materially reduced if all sticks over 8 inches in diameter are split once and all those over 12 inches are split twice. Length of stick has little effect on seasoning rate.

Silviculture

1. It has long been observed that young spruce-fir stands generally have a greater proportion of fir than was present in the original growth. Because balsam fir is subject to decay at an early age, yields can be greatly increased by changing from clear-cutting to partial cutting on short cycles in order to salvage balsam fir which would otherwise be lost through rot. Since cull from decay is not appreciable until balsam fir is 50 years of age and since losses from decay and windfall become critical after 70 years of age, it can now be stated that 20 years should be the maximum length of cutting cycle for best utilization of balsam fir.

2. Yields of spruce-fir pulpwood on cutover lands can now be predicted by the use of tables based on 15 years study of actual production on such lands.

3. Logging damage in second spruce-fir pulpwood operations is no deterrent to partial cutting. Fir suffers more than spruce, losses averaging 3.3% as compared to 1.1% for spruce. Forest managers can readily allow for logging damage in marking by reserving from 1 to 5% more than required for the residual growing stock.

4. Group selection cutting develops the best type of reproduction in northern hardwoods, combining the desirable reproductive features of extensive clearcutting and tree selection. It

is also best suited to many run down stands where removal of groups of overmature and decadent trees is needed. It is less satisfactory where red maple or aspen will dominate reproduction through prolific sprouting.

5. Advance reproduction over 1 ft. high in northern hardwoods determines the future stand after selection cutting. On the other hand, after clearcutting the composition indicated by advance reproduction may be radically altered.

6. Accelerated diameter growth of northern hardwood trees after selection cutting increases with proportion of the stand removed and is greatest in small trees. Little or no acceleration is evident in trees over 18" in diameter.

7. Weeding has not proven of value in northern hardwood stands under 20 years of age, but mowing of advance reproduction in conjunction with harvest cuttings has been highly satisfactory from a silvicultural standpoint as stagnated, crooked advance growth is converted into a fast growing stand of straight saplings. If these advantages are maintained mowing may prove to be financially justified.

8. Present high prices for lumber and fuelwood make it possible to improve white pine woodlots, by removing poorly formed trees along with good ones. According to 1941 studies two or three fairly good trees will cover possible losses on each "wolf" removed. In many cases trees formerly considered unmerchantable can now be removed at a profit.

9. Tests of applicability of simple rules of cutting practice designed to keep stands reasonably productive confirm the belief that fairly good silviculture will result from their use.

Regeneration

1. Spectacular results in a planting experiment with 2 hybrid poplar clones indicate that organic content of the soil as well as cultivation is a major factor in successful establishment. This may be of significance for hardwood plantings in general.

2. Tests show that there is no basis for the belief that germination of red oak acorns prior to sowing is of value in securing seedling stands. Injury to emerged radicles is unimportant in seedling development, even if half the emerged radicle is removed.

3. Reduction in density of sowing white pine in seedbeds improved the development of seedlings by 40 to 100% in characteristics such as stem diameter, length and number of roots. Differences of seed origin resulted in variations of such characteristics ranging from 36 to 188%.

4. Successful rooting (up to 40%) of greenwood cuttings from old sugar maple trees (over 60 years) was obtained for the first time by using a layer of horse manure below the rooting medium in sash beds.

Genetics

1. Close pollination on three species of elm shows self-compatibility in all. This opens the way for line breeding which may be a short cut to development of types resistant to Dutch Elm disease.

2. Successful greenhouse breeding on cut branches of hybrid poplars suggests this method to facilitate breeding of other spring seeding species such as elm and soft maples. Since dormant flowering branches are easily shipped, this method makes possible the use of stocks of wide geographic distribution.

3. Sap from individual sugar maple trees testing 4 percent in previous years ran as high as 10 percent sugar during the abnormally dry spring of 1941. The highest concentration previously reported is approximately 6%.

4. Although natural polyploidy, which may produce exceptional types of trees has been reported in red maple living polyploid material has not previously been perpetuated. Having identified a seedling with 78 chromosomes from Michigan seed and one with 104 chromosomes from New Haven parentage, the two seedlings are now being grown for breeding and comparative study of wood quality and growth.

5. Voltage gradient measurements may be a useful tool in forest genetics research. Red maple flowers showed a high peak when receptive, with a sudden decline when past. This phenomenon should facilitate determination of receptive periods in flowers of such species as oak and hickory where no visible criteria of receptivity are available.

Forest Protection

1. Measurement of heat transmission through the bark of three species shows that beech is particularly susceptible to fire injury and balsam fir somewhat less so, while hemlock is at least twice as resistant to fire as balsam fir.

2. The opportunity for silvicultural control of the gypsy moth in southwestern Maine, where defoliation has been widespread and recurrent for many years, is indicated by a survey involving over 1 1/4 million acres of forest land. If white pine is classified as a resistant species because gypsy moth larvae cannot survive on it in their early stages, over 80% of the woodland may be classified as dominantly or fully resistant and only 11.5% dominantly

or all favored. About 1/4 of the area requires no treatment at all; another third merits high priority for treatment because of large potential value loss in relation to cost of treatment; only 10% of the area is classed as not being susceptible to treatment except by complete type conversion.

3. Analysis of gypsy moth control efforts in the anthracite region of Pennsylvania leads to the belief that continued hope of eradicating this large infestation is not justified. This conclusion, coupled with widespread appearance of the gypsy moth in and beyond the barrier zone in New York, raises serious question as to continuation of the barrier zone project.

FORESTRY ASPECTS OF THE CURRENT ECONOMIC SITUATION

Following the hurricane of 1938 it was anticipated that as soon as the increased activity in lumbering incident to salvage of wind-thrown timber waned there would be a drastic decline in lumbering operations throughout the hurricane zone. This might require drastic economic adjustment in rural communities which are dependent in large measure upon the forests and forest industries for local revenues and employment of the population. However, the stimulating effect of the war upon the economic life of the country has tended to absorb the shock of the hurricane aftermath. On the one hand, industrial activity, rising to new high levels to meet the demands of wartime production, has reduced the problem of reemployment of labor to insignificance. On the other hand, higher prices and more active lumber markets have greatly stimulated cutting and thus postponed the inevitable decline of the forest industries in the hurricane zone. In spite of this, economic readjustment resulting from the hurricane is evident in many communities. Some mills set up and equipped for long term operation have had to close. The life of other operations is threatened. Tax delinquency has assumed alarming proportions in New Hampshire during the past few years. Recreational values have been permanently impaired.

Accelerated cutting for war use throughout the region is causing increasing concern lest growing stock become so badly depleted as to make it utterly impossible to sustain any significant volume of production in the forest industries. The situation is especially serious in the pine region of central New England where the war impact is superimposed upon the heavy depletion of merchantable timber in the 1938 hurricane. It is also critical with respect to the better species which are most in demand, specifically sugar maple and yellow birch. Statements by state foresters, extension foresters, lumbermen and land owners all point to the critical character of the situation, make it clear that prompt action is needed, and indicate that public regulation is the only answer.

The question of public control on private lands has already been the subject of preliminary legislative action in Massachusetts and New Hampshire. In each of these states local advisory boards have been set up to study the problem and make recommendations for such action as may seem necessary to conserve the public interest in forest land. The Massachusetts law specifically charges the advisory committees to hold public hearings to determine the best forest management practices for each district and to report findings. In Maine the state forester has held conferences of land owners and operators from which it appears that a plan of state action paralleling closely that suggested in the Pierce Bill, (H.R.3850) is likely to emerge. At a recent conference of the Commission on Interstate Cooperation sponsored by the Council of State

Governments a committee of state foresters was charged with the responsibility of considering the entire forestry problem and drafting a uniform state law covering the needs with especial emphasis on the regulation of cutting on private lands. This may have prompt and far-reaching significance.

All of this points to the necessity of stimulating thinking by responsible and interested persons on rules of practice for the major timber types. About a year ago Region 7 and the three eastern stations jointly formulated tentative rules of practice basing minimum standards primarily on leaving a residual stand of specified number of trees. During the past season field checks by the Northeastern Station, involving actual marking and inspection of selected stands both before and after cutting indicate that in general such rules will give fairly good silvicultural results. However, some of us at the Northeastern Station have taken the position that the rules would be sounder in principle and more satisfactory for the educational process of administration if specifications were based first on restricting the cutting of immature trees, defined in terms of diameter class, to improvement of the stand in spacing, quality, composition or condition for restocking; and second, upon partial cutting, defined in terms of minimum percentage of residual basal area, as the general standard from which exceptions may be authorized by a local administrative agency under specified conditions.

Independent work along this line has been done by the Committee on Silviculture of the New England Section, Society of American Foresters. A report presented in preliminary form last year is to be given further discussion this winter. Recommendation was recently made by the retiring chairman of the New York Section that similar study be given to the problem by a committee in that state. There is no doubt that much educational work is needed to clarify and unify thinking in the matter of forest practice rules. Such educational efforts should be supported by numerous demonstration markings and field tests. It may be confidently expected that much of the opposition to regulation and skepticism as to its feasibility will be broken down as foresters and land owners gain a clear perspective of specific requirements for each type.

Because of the war the production of fuelwood has come in for special consideration during the past year. The possibility of shortage of coal and oil in New England, arising from transfer of tankers to the service of England, and the fear that normal transportation facilities might otherwise be disrupted or prove inadequate provide the background for special educational campaigns to stimulate the cutting of wood fuel under technical guidance as a measure of salvage and stand improvement. New impetus to action in this field has been provided recently by the sinking of tankers along the eastern seaboard, increasing uncertainty regarding water shipment of coal and the danger that rail transportation may be crippled by air raids. Even if no fuel

shortage develops, a fuelwood campaign is justified because, as a result of scarcity of labor, much less than the normal supply of wood was cut last year and production for next winter's needs is at an equally low level. In both Connecticut and Massachusetts forestry agencies have united in fuelwood campaigns, the most interesting features of which are efforts to get people in rural communities to cut wood for their own use on public lands or under cooperative arrangements with farmers or other landowners.

New England forests which have been subjected to repeated waves of unrestricted cutting dating back to the first settlement of the country are now facing a period of depletion which threatens to be far more serious for the region as a whole than anything that has gone before. Under these conditions it is important not only that prompt measures be taken to cushion the adverse effect of increased production by control of cutting practices to conserve the minimum growing stock essential for future productivity, but also to maintain a comprehensive and well-rounded research program to provide the fundamental technical knowledge essential to successful solution of forest management problems which are becoming increasingly exacting as the need becomes more acute. Anticipating that the post war period will bring proposals for public programs of forest restoration, research activities should be strengthened now in order that such work programs may not be handicapped by lack of adequate technical background as was the case when the Civilian Conservation Corps was established. A more sympathetic attitude toward forestry practice now evident among men in the forest industries is indicative of a favorable atmosphere for the initiation of pilot plant experiments and demonstrations aimed at expanding and integrating our knowledge in the fields of silviculture, economics, utilization and protection.

MAJOR PROBLEMS AND WHAT IS BEING DONE ABOUT THEM

In broad outline, forest conditions and research needs in the Northeast remain essentially the same as described in our annual reports for 1937 and 1938. Because of diversity of conditions, it is helpful, as pointed out in those reports, to visualize the region in three zones, namely the sparsely settled wild lands of the north, which contain the bulk of the merchantable timber supply but in which intensity of forest practice will generally be limited by inadequacy of transportation; the densely populated industrial zone, in which sawtimber growing stock is already depleted almost to the vanishing point; and the intermediate farm woodland areas which still have some sawtimber, are well served by transportation facilities, have easy access to labor, have adequate numbers of local workmen, except in times of industrial boom, and have access to diversified markets.

Without restatement of background and needs as set forth in the 1937 and 1938 reports, the following discussion aims to give the status of major problems of the region.

1. Forest Survey.

The long standing and widespread interest in the forest survey has been re-kindled by the agitation for forest regulation and apprehension as to future, arising from the accelerated cutting for the war market. Numerous independent public expressions on this matter have been heard in recent months. Pending the time when the regionwide survey can be inaugurated several special projects to supply information for local needs have been undertaken. Between 1936 and 1938 three separate projects were undertaken by the Civilian Conservation Corps. Two of these were sponsored by Region 7 in order to obtain information on local resources in connection with the establishment of forest cooperatives in Coos County, New Hampshire and Tioga County, New York. The third, covering almost two million acres in southwestern Maine was undertaken at request of the Maine Forest Service and was given technical guidance by the experiment station.

In the Maine project major interest attached to preparation of a type map, but stand tallies and growth data were also obtained at our request. It has not been possible to complete the office computations and analysis of the inventory and growth data. During the past year, however, the information on forest types was analyzed with respect to the opportunity for silvicultural control of the gypsy moth. The forest types recognized in the survey were classified according to the normal proportion of species resistant to, or favored by, the gypsy moth occurring in them, with results as follows:

Fully resistant	26.7%
Dominantly resistant	55.0%
Equally Divided	6.8%
Dominantly Favored	9.8%
All Favored	1.7%

Based on value of potential losses in relation to the cost of silvicultural measures to increase resistance, the opportunity for silvicultural control was evaluated in four classes as follows:

(A) Highest priority -- areas where potential value lost is substantially in excess of cost of treatment 35%

(B) Low priority -- areas where costs of treatment assume relatively large proportions in respect to potential reduction of loss 29%

(C) Types in which resistance can only be developed by complete conversion 10%

(D) Fully resistant types requiring no treatment 26%

From this it appears that strong incentive exists for utilizing public works programs in this region for stand improvement measures to increase resistance of the forest to gypsy moth. Certainly land owners and forest managers should make resistance to gypsy moth a primary objective in their plans for forest management. This is especially important because the territory in question has been characterized by widespread and recurrent defoliation for several decades.

Questions as to the adequacy of timber supply to sustain the operations of the Otsego Forest Products Cooperative Association in New York state led to undertaking an extensive survey project in that area during the past year. This project was made possible by the availability of labor from Civilian Public Service Camp No. 12 located at Cooperstown. The work has been planned and checked by representatives of the regular Forest Survey organization and is meeting usual Forest Survey standards. Information is being obtained for a unit of about 2500 square miles by running lines four miles apart and taking plots at 8 chain intervals. With field work completed for more than half the unit, preliminary analysis substantiates earlier crude estimates of available timber resources. Now that men from Civilian Public Service camps may be assigned to work away from camp on detached service, provided the work agency can pay for their subsistence, the way is open to carry the survey forward on a statewide basis in the northeast. An allotment of $6,000 would enable us to keep six three-man parties in the field and carry office work currently. For every dollar thus allotted we would be getting almost seven dollars in value of cooperative service from the work camps. Recognizing the urgency of the current situation and the persistence of the demand for forest survey information, I cannot renew too strongly my recommendation that survey money be allocated at once to take advantage of the Civilian Public Service camps here and keep the crews already trained for the work on the job without interruption.

2. Gypsy Moth Control.

The barrier zone project of the Bureau of Entomology and Plant Quarantine and the New York State Conservation Department aimed at confining the gypsy moth to New England is of significance because of the amount of public money involved and because of divergent opinion as to its effectiveness. During the summer of 1940 the Bureau of Entomology engaged C. F. Korstian, a forester, and A. G. Huggles, an entomologist, to study the problem of gypsy moth control in all its phases. This committee recommended that the barrier zone be maintained in some form, but their report makes no mention of the large infestation in Pennsylvania, gives no analysis of fluctuations of moth populations, presents no statistical evidence of past progress and makes no attempt to evaluate cost and result. Because of recent spread of the gypsy moth over a wide area in and beyond the barrier zone in New York and because there is such a general lack of understanding of the situation and of the factors involved among foresters, it seemed desirable to get first

hand information regarding the Pennsylvania infestation. Obviously any proposal for strengthening effort in the barrier zone would depend for its justification upon the prospect of eradicating or isolating the infestation in Pennsylvania. The difficulty of the terrain, the size of the job, and the failure to materially alter distribution of the pest after eight years of effort lead me to believe that eradication in Pennsylvania will not be possible. To isolate the Pennsylvania infestation by a new barrier zone would involve an area comparable to that of the Hudson Valley barrier. In the light of all this it is suggested that objectives for gypsy moth control be redefined and that plans for any future work be set up so as to permit statistical evaluation of accomplishment. Our study disclosed a rather striking correlation of forest composition with area of general infestation in Pennsylvania and substantiates the recommendation of Horstian and Ruggles that gypsy moth research should be strengthened with especial reference to the ecology of spread and factors operating to preclude widespread defoliation in the oak regions south of the Massachusetts line.

3. Forest Influences.

Hydrological relationships developed in connection with the flood control survey on the Connecticut River watershed during the past year appear to confirm fully all theoretical claims as to the importance of well managed forests for watershed protection. Water holding capacity and water retention characteristics of forest soils are definitely related to depth and character of the organic layers. By correlating depth of organic layers with type, age and condition of forest cover it was possible to calculate theoretical runoff for storms on watersheds for which actual records of runoff were available. Results of such tests lend confidence to predictions of changes in runoff which would result from modifications of forest cover. In these analyses it was clearly shown that depth of humus layers is related to type and age of forest and therefore subject to considerable control by forest management. Since optimum watershed conditions appear to obtain under a mature or many-aged stand of mixed species of long-lived hardwoods and conifers, it follows that these results provide a strong basis for partial cutting and for public control.

The work done on the Connecticut Survey opens a vista of great possibilities in the field of forest influences. It provides clear cut and positive orientation for comprehensive and thorough-going research in this field. The character of the results is such as to make it highly desirable that such work get under way without delay. Here again the results will have an important bearing on the orientation of public works programs which are likely to play a large part in economic readjustment after the war.

4. Forest Taxation, Insurance and Credit.

The economic problems of forest taxation, insurance and credit remain as basic considerations in furthering the practice of forestry

on private lands in this region. In these fields the research foundation for action has already been provided, but little progress has been made in crystallizing action. Of these problems forest taxation is the one currently receiving most attention.

During 1941 the Massachusetts legislature revised its forest tax law so as to give owners of forest land the benefit of special classification without any action on their part. This effort at statewide application of a yield tax law involves a technical difficulty of arriving at an adequate definition of "forest land".

In New Hampshire a strong movement is under way to authorize amendment of the constitution by referendum this fall so as to open the way for special assessments, rates and taxes on growing wood and timber. Support for this campaign is gathered from new examples of extensive liquidation in order to avoid heavy annual taxation. Due to the hurricane and cumulative depletion of growing stock, adjustment of local revenues to special forest taxation would no longer constitute the serious obstacle which it formerly did in many rural towns.

Taxation has also been under consideration in the New York Section, Society of American Foresters. A proposal has been made to classify standing timber on lands under satisfactory forest management as personal rather than real property which would have the effect of automatically exempting it from taxation. Although this principle is believed to be unsatisfactory, it attracted considerable interest and may pave the way for a more mature proposal based on findings of the Forest Taxation Inquiry.

5. Partial Cutting for Restoration of Forest Growing Stock.

As pointed out in the 1938 report, the most fundamental problem throughout the northeast is to restore and improve forest growing stock so as to provide a sound basis for profitable sustained yield management. This involves working out the best methods for partial cutting, coupled with educational effort to minimize clear cutting and premature harvesting of second growth timber. Because of a renewed interest on the part of many large timberland owners in the practice of forestry and the importance of attempting to offset in some degree the adverse effects of increasing activity in woods operations, considerable emphasis was placed on the selling end of the job during the past year. Fresh contacts were made with 11 of the large companies controlling a good half of the lands in the spruce region. Field contacts included advice on cutting methods for new operations such as those of the Paul Smith Hotel Company in New York where a change from uncontrolled stumpage selling to a program for conservation of an appreciable amount of growing stock was instituted, and the St. Regis Paper Company in New Hampshire which adopted exceptionally fine standards for protection of advance reproduction and sapling growth of spruce and fir. Other field contacts included inspection of cuttings and suggestions for treatment of specific areas on such progressive operations as those of the Passamaquoddy Land Company and the F. D. Warren Company in Maine and

Finch-Pruyn and Company in New York all of which have been influenced by the work of the Station. In office contacts problems of partial cutting, the application of tables recently issued for estimation of spruce-fir yield on cutover lands or the possibilities of cooperative demonstration cuttings were discussed with The Great Northern Paper Company, the Maine Seaboard Paper Company, the Brown Company, the International Paper Company, The Raquette River Lumber Company and Prentiss and Carlisle, consulting foresters.

In southern New England requests for assistance in inaugurating forestry programs were received from a group of landowners in Berkshire County, Massachusetts and from a land holding company in northeastern Connecticut. In both instances advice was given on cutting practices, demonstration marking was done on the ground and foundations laid for cooperative experiments in partial cutting. Similarly the station's advice was sought by the Massachusetts State Conservation Department in connection with spruce cuttings on the October Mountain State Forest.

Perhaps the most tangible evidence of station influence for good forest practice is to be found on the operations of some 250 farmers who delivered logs to the Otsego Forest Products Cooperative Association, Cooperstown, New York last year. Since the farm woodlands average about 30 acres per farm, it is evident that through the station's efforts conservative selection cutting was applied to about 7,500 acres in the Cooperstown country during the year. Beyond that, the influence of the station has also had a bearing on the forestry program of the Clark Estates involving about 1800 acres of woodland at Cooperstown. Quite recently the management of the woodland operations on these estates has been turned over to the Otsego Forest Products Cooperative Association. This represents additional evidence of the growing confidence of people in that community in the cooperative forestry program for which the station has been so largely responsible.

During the year the station has again cooperated with Region 7 in working for effective application of spruce-fir and northern hardwoods silviculture on the White and Green Mountain National Forests. Demonstration markings in a mixed stand of northern hardwood and spruce on a proposed timber sale on the White Mountain National Forest have proved of real aid to the district rangers in translating research findings into woods practice. It is anticipated that this form of cooperation with the region will be frequently repeated.

Station work served as the basis for discussions of partial cutting practices in spruce at the field meetings of the New York Section, Society of American Foresters and of the Society for the Protection of New Hampshire Forests. In addition, groups of students from Yale, Harvard and Cornell were given field instruction on the Yale Myers and Finch Pruyn Experimental Forests. The Northeastern Forest Research Council spent a day in the field on the Cooperstown project and numerous other visitors have come from many states to learn about the work being carried on there.

The background for all these efforts to stimulate partial cutting and conservation of growing stock was materially strengthened by new research contributions during the year which are summarized in the following paragraph.

Spruce-Fir

For timberland owners interested in growing timber as a long term investment it is essential to be able to predict with reasonable accuracy future timber yields from lands of differing productivity. As an aid in this direction tables showing the volume of growing stock which may be expected to develop on spruce-fir cutover lands have been prepared by the station based on 15 years of observation of actual production on such lands. These tables may be used to predict growth on any tract based on survey data classifying the area by type and period since cutting and giving the average number and size of trees for each subdivision. These tables have been well received and appear to be meeting a long felt need not only in this country but also in Canada. Prentiss & Carlisle, consulting foresters, applied them at great saving in the appraisal of future pulpwood values on a 25,000 acre tract in the Adirondacks. G. C. Piché, consulting forest engineer in Quebec, anticipates applying these tables to holdings of his clients aggregating some 2,000 square miles.

Observations throughout the spruce-fir region show plainly that because of the usual long period between successive cutting on the same area there is a huge loss of balsam fir through decay and windfall. It is believed that management on short cutting cycles so as to utilize the balsam fir which now goes to waste may perhaps double the average yield per acre of spruce-fir lands. Because of its short life, many operators, planning in terms of clear cutting, do not include any balsam in their calculations of future yield. Yet balsam fir constitutes a much larger proportion of the growth on cut-over lands than it did in the original stand and its relative importance has been increasing since clearcutting became a general rule. Hence, the increased yield which will result from partial cutting aimed at best utilization of balsam will perhaps do more than any other one thing to stimulate improved silvicultural practices in the spruce-fir region. Because of the importance of this factor decay in balsam fir has been the subject of intensive study. Butt rot in balsam fir becomes significant at about 50 years of age and increases rapidly until at 70 to 80 years it is present in the majority of trees. Windfall largely induced by butt rot destroys large number of affected trees over 70 years of age. It is therefore concluded that the cutting cycle in the management of spruce-fir stands should not be more than 20 years, with partial cutting removing balsam fir between 50 and 70 years of age and taking spruce on a selection basis.

With the background of specific silvicultural information being constantly built up in this way it becomes desirable to have adequately

controlled demonstrations of the practical application of partial cutting methods. Experimental operations on a series of plots operated on a commercial basis in 1937 and unfortunately destroyed by the hurricane in 1938 aroused much interest. On this operation partial cutting cost no more than clear cutting for the same skidding distances and there was very little difference in cost between light and heavy cutting. Later studies show that logging damage to the residual stand need not assume serious proportions. It can be readily offset in the marking by allowing about 3 to 10% for balsam fir and 1 to 5% for spruce, depending upon composition and average diameter. Because of the increased interest in partial cutting it is important for the station to expand its work in this field. The plots wiped out by the hurricane have already been replaced by two new series of plots in second growth spruce and fir in the White Mountains. Preliminary plans for experimental cuttings on the lands of the Passamaquoddy Land Company in Maine selected after consideration of several other possible locations will doubtless have to be laid aside because of the war.

Northern Hardwoods

Methods of cutting experiments on the Bartlett Experimental Forest involving clear cutting, tree selection and group selection are yielding interesting results. Group selection appears to be the best method for handling northern hardwoods. Group selection plots show none of the inadequacies of clear cut areas, reproduction being largely of valuable species, while pin cherry, grasses and berry bushes are kept to a minimum. Advance reproduction is generally ample and of good species, but on clear cutting the composition of the new stand may be altered radically by excessive exposure in the first year and the subsequent invasion of pin cherry and light seeded species. On selectively cut areas hardwoods less than a foot tall have poor chance of surviving and can be ignored in predicting the future stand of young growth.

Weeding has not proven to be of value in northern hardwood stands under twenty years of age, but mowing of reproduction in conjunction with harvest cuttings has been highly satisfactory from a silvicultural standpoint in that stagnating crooked advance reproduction is converted into a fast growing stand of well formed saplings. If these advantages are maintained mowing may prove to be financially justified for widespread application.

Net growth in selectively cut stands remains about the same as in untreated stands after 25 to 30% of the volume has been removed. This increment is of greater value on the selectively cut areas because it is being laid on trees holding the greatest promise for future production. Acceleration of growth on individual stems is confined largely to trees less than 18 inches in diameter.

The economic value of partial cutting for farm woodland owners was clearly brought out in a cooperative study conducted by the Bureau of Agricultural Economics in Otsego County, New York. This showed that

farmers participating in the program of the Otsego Forest Products Cooperative Association could count on an average annual income from the forest amounting to about 15% of their total net cash income. In this program regularity of income is encouraged by cuttings which have averaged only about 20% of the merchantable volume and frequently take less than 10%. With prospective returns of this proportion there is every incentive for farmers to make forestry a regular part of their farm business whereas with clear cutting woodlands become less and less significant in the economy of the region. The economic advantage of partial cutting is further brought out by appraisals showing that 80% of the stumpage value in merchantable northern hardwood stands is found in trees 18" or more in diameter and that 60% of the number of trees in the merchantable growing stock may be conserved for future growth if cutting does not go below 18".

Plan for Production Cost Work:

As indicated in last year's report the station has been looking forward to integrating its work in silviculture, economics and utilization through "pilot plant" demonstrations. It is clear that experimental operations of this nature will contribute much to better understanding of the many problems involved in the application of partial cutting practices. It is also evident that in such work emphasis should be placed on the economic aspects. Thus in the field of forest management production cost analyses should assume an increasingly important part. Because production cost studies call for a particular kind of specialized training and because of the opportunity they offer to explore methods of effecting economies by modifying operating techniques and trying out new equipment, it is believed that they should be set up on a project basis under the supervision of a specially trained leader rather than to be left as an added burden to the men who specialize in silviculture. The men assigned to such a production cost project would constitute a service agency to work with other project leaders and their men or with temporary field assistants in conducting cost analyses on pilot plant operations or on any major plot installation. Our proposal to inaugurate such a project must apparently be laid aside for the duration of the war because of prospective curtailment of work in the northeast.

6. Utilization of small and low grade material.

Because of the depletion of sawlog growing stock throughout much of the region, progress in forestry practice is largely contingent upon successful utilization of small and low grade forest material. The active market for both lumber and pulp which has developed as a result of the war offers better opportunity for disposal of low quality timber than has been available for many years. The demand for pine bombboards, for example, is so keen that operators are going over areas damaged by the hurricane to pick up trees which were too small to handle in the course of the original salvage operation. But as pointed out in the first section of this report, there is grave danger that ability to sell material of almost any size or grade will serve simply to hasten the stripping of immature stands and accentuate the difficulties of forest

depletion. Under proper control and competent technical guidance this market should serve as a means of renovating run down woodlots and putting them in shape for sustained production of better grade products.

White Pine

In an effort to capitalize on this opportunity, the station has distributed widely a technical note entitled "Collect the Bounty on Your Wolf Trees" based on an analysis of the cost and returns in working up a number of selected white pine trees on the Lassabesic Experimental Forest. This shows clearly that the willingness of operators to take logs, no matter how rough they may be, justifies the work of cutting out the wolf trees so generally prevalent in second growth pine stands even though in individual cases the labor involved may exceed the value of the product.

Another short term study of a partially cut tract of white pine resulted in preparation of a paper entitled "Renovating the Woodlot for Sustained Yield". This emphasized the opportunity to rid stands of poor trees at good prices and thus putting the woodlot in shape to produce more valuable material. Growth predictions indicate that a residual stand of 4,600 bd. ft. will increase to over 17,000 bd. ft. in 20 years and that distribution of size classes would then be such as to permit cutting at short intervals averaging at least 600 bd. ft. per acre per year.

Some light was also thrown on the danger from sunscald which must be taken into consideration in silvicultural operations in second growth white pine. That sunscald is a winter injury which may not make its appearance until several years after exposure was indicated by study of cambial temperatures, microscopic examination of injured tissue and failure of sunscald to develop during the summer on white pine trees exposed at different seasons.

A good start was made in the establishment of demonstrations of partial cutting and cultural measures to utilize low grade timber and improve quality of the growing stock on the Lassabesic Experimental Forest. Although plans depended largely upon the now defunct C.C.C. camp near the forest, considerable success has been attained in selling timber on the stump to farmers who work part time getting out fuelwood and logs. Active cooperation was maintained with the Forest Insects Laboratory, the office of Blister Rust Control, the University of Maine and the State Extension Forester.

Fuelwood Utilization

The war situation emphasizes the significance of the work on fuelwood utilization undertaken by the station in cooperation with state agencies in Connecticut under the Norris-Doxey farm forestry program. Design of portable charcoal kilns of two sizes which are easy to erect and operate was published as Bulletin 448 of the Connecticut Agricultural Experiment Station. Although charcoal prices have advanced more than 50% so that the manufacture of charcoal should be profitable for the duration of the war, it is unlikely that many woodlot

owners will be able to put up portable kilns because of difficulties of obtaining the necessary sheet metal.

In studies of cordwood production some attention is being given to use of power tools. Tests were made of a logging arch designed especially for cordwood, but this did not prove suitable for the rough ground and dense stands of Connecticut. Some encouraging results were obtained in the use of U-shaped frames for cross hauling a full cord of wood onto and off of sleds. A new type twisted wedge for splitting did not prove to have any advantage over the usual straight pattern wedge. Although it seems likely that power tools can be developed to increase the efficiency of bucking and splitting wood at yard or roadside, for the present it is recommended that fuelwood be produced by felling trees up to 12" in diameter with the axe and pulpsaw and that for trees above this diameter a two-man cross cut saw be used. Wherever it is possible to skid long lengths, bucking, splitting and piling should be done in a yard or at the roadside. Tests of seasoning red oak extending over a period of six months show that while length is important, rate of seasoning is related to diameter and may be accelerated by splitting.

Because of "priority" difficulties in obtaining part of the necessary equipment it has not been possible to complete the tests of burning hogged wood in the central heating plant of a state institution. In connection with this study it was found that hogged wood may be produced at a cost of less than one dollar per cord, 8 or 12' sticks being more economical to handle than 4' lengths.

The significance of the fuelwood project was further emphasized at the same time that a new opportunity for cooperative field experiment was opened up when the Quinebaug Forestry Company of Southbridge, Massachusetts and Union, Connecticut decided to thoroughly explore the possibilities of commercial forestry on their property. The Quinebaug holdings comprising about 7,500 acres were hit heavily by the hurricane. Most of the merchantable pine was blown down and extensive plantations about thirty years old were badly damaged so that the remaining opportunity for income lies almost wholly in the disposal of hardwood cordwood and the further salvage of young pine windthrown in the hurricane. The company is well financed, has good business connections and is willing to make a substantial investment in equipment in order to develop new uses or enter the market on a volume production basis. There is also a keen interest in the possibilities of mechanization. Three brick charcoal kilns of 80-cord capacity each have been constructed and are in operation. A contract has been obtained for delivery of 5,000 cords of pulpwood to a large roofing manufacturer. The Company and the Station have entered into a cooperative agreement which provides that all cutting is to be done in accord with sound forestry practice to be mutually agreed upon, and that provision shall be made for modifying operating practices for experimental purposes, testing new equipment and establishing, protecting and maintaining experimental plots as required by the station for demonstrations of silvicultural practices. Thus, in exchange for technical guidance and cooperation in experimental work, the stage is set for inauguration of a compre-

hensive series of pilot plant operations under exceptionally favorable circumstances. The station project leader is now stationed at Southbridge, Massachusetts and is concentrating his activities on the Quinebaug operations.

Inasmuch as the company has contracts for more wood than can be safely cut from its own property, arrangements have been made to take over operations on the adjacent Yale Forest which also comprises about 7,500 acres. Consideration is also being given to the possibilities of group action so that the forestry program may be extended to other owners in the vicinity. In this connection a new Norris-Doxey project was recently approved by the Soil Conservation Service and it is expected that a project forester will soon be assigned to the area by the State Forester.

7. Improvement of Logging Methods, Equipment and Organization.

As indicated above a little work in this field has been accomplished in connection with the Connecticut Fuelwood Project and cooperation with the Quinebaug Forestry Company opens the way for a much more comprehensive program dealing with problems of the depleted second growth of the oak region of southern New England. Similarly, some attention is being given to work along this line in connection with the cooperative forestry project at Cooperstown, New York. Thus far, efforts there have been primarily concerned with the organization of a large number of small jobs in a community where the number of skilled men and the amount of equipment suitable for the work is limited. Coordination of the various jobs to assure a steady flow of logs to a central plant presents many difficulties which will doubtless disappear as the community becomes adjusted to the increased volume of woods activity occasioned by the inauguration of the cooperative program.

In our 1940 report it was indicated that first priority would be given to the spruce and northern hardwood region in our effort to inaugurate pilot plant experiments which would have as their major objective the integration of improvements of logging methods, equipment and organization of operations with methods of partial cutting, improvement of forest growing stock and economic limitations imposed by relative accessibility, opportunity for close utilization and financial requirements. During the year the possibilities of cooperation in such comprehensive experiments were discussed with a half dozen of the important timberland owning companies in northern New England and New York. There appears to be little prospect of selecting any single tract upon which a series of experimental operations could be satisfactorily carried out year after year, but it should be possible to attain our objective by integrating a number of separate jobs undertaken on areas selected because of their suitability for each particular undertaking. For the initial effort it was planned to make a study of partial cutting on property of the Passamaquoddy Land Company in southeastern Maine. This company is now practicing some of the most advanced spruce silviculture of any of the pulp and paper concerns in the region.

In the proposed experiments opportunity would be offered for not only varying the character of cutting, but also for comparing variations in operating methods in an attempt to reduce cost.

With plans for the immediate future crystallizing in this way consideration of further development of the pilot plant program was laid aside in order to respond to the many calls which were coming in for advice and aid in setting up new forestry programs and applying the results of station work from operating companies and consultants. While the importance of pilot plant demonstration has not been altered, our best opportunity to further the application of good forestry practice in the region with the limited resources available to us at present has seemed to lie in capitalizing on the wave of active interest by the operating companies to sell our previous work directly and cooperate with the Division of State and Private Forestry in working for the application of thoroughly sound forestry practices.

8. Cooperative Organization for Farm Woodlands.

Since the station started work on the cooperative forestry project at Cooperstown, New York in 1935 seven other forest cooperatives have come into existence in the northeastern region. The oldest of these was organized at about the same time as the Cooperstown project in Coos County, N. H. and Essex County, Vt. This was set up primarily as a marketing agency with an F.S.A. loan to finance pulpwood cutting by individual members. It subsequently undertook the marketing of hardwood sawlogs and Christmas trees. It has not been possible to exercise very close control over cutting practices, but this season it has started to mark every stand to be cut. The need for some control of processing facilities has been felt and, through a subsidiary, a small sawmill has been operated. It has employed a full time technical manager and has had the benefit of technical guidance from the Extension Service and the Division of State and Private Forestry.

A third cooperative was organized in Tioga County, New York by the Extension Forester. This started on a small scale to provide a channel for marketing farm woodland products and to encourage conservative cutting. Initial interest developed primarily among nonresident owners who had no other satisfactory way of operating their woodlands. The program has never been large and activity seems to have lagged after the first three years, possibly because resident owners find little incentive for cooperation now that the war has stimulated an active demand for stumpage. Another cooperative venture in New York, centered largely around one large owner whose sawmill was made available to the group failed after one year's operation primarily because of weak management and inadequate educational effort. A forest cooperative offering marketing service has also been organized in Essex County, Ne York in connection with the Morris-Doxey forest farming project there.

In Carroll County, New Hampshire a cooperative, organized in 1940, has had the cooperation of a Morris-Doxey project forester. This organization now has a local manager who works on a commission basis. Members are mostly part time summer residents. The project forester prepares maps and working plans for which a charge of 10¢ per acre is made. Marking for cutting is done at the rate of 40¢ per M. Last year some 6,000 acres were mapped, and the gross volume of business handled was about $5,000. The association holds back 10% of the amount received for the product to cover its operating expense. A small mill is operated and the product is sold almost entirely to one lumberman.

The Carroll County Cooperative is handicapped in meeting competition from strongly financed commercial competition because it is unable to pay farmers for logs until the product has been sold. Because of the rapidity with which merchantable stands in the county are being stripped by other mills, this cooperative is in danger of being unable to sustain its operations.

Another cooperative known as the Ashuelot Forest Owners, Inc. was organized during 1941 at Harlow, N. H. primarily for the purpose of salvaging a large volume of timber destroyed in a disastrous fire. Lumber is manufactured in a mill owned and equipped for the purpose by one of the members. In addition to a technical manager this association also has the benefit of a project forester sponsored by the Extension Service.

The youngest forest cooperative in the region was organized in York County, Maine in 1941. This is a marketing agency through which the service of a technical forester becomes available to members at an hourly rate. With only a few members, several of whom are sawmill operators, the enterprise has not yet made much progress. It is sponsored by the Extension Service and the white pine project leader at the Station has rendered assistance whenever possible.

Viewing this cooperative experience as a whole, it may be said that organization of a marketing cooperative gives no assurance that better forest management will be practiced. It also appears that bargaining cooperatives which do not operate a processing plant are unlikely to succeed unless those who purchase the products are sympathetic with the objectives and give active support to the program. It is also quite evident that problems of forest cooperatives change with market conditions and that there is serious question whether a marketing organization can offer farmers sufficient incentive to maintain forestry practices in boom times when logs can be sold without difficulty anywhere.

The Otsego Forest Products Cooperative Association is by far the largest and most active organization in the field. By the end of 1941 membership reached 765 and operations had been conducted in approximately 500 woodlots. During 1941 about 3 million board feet of lumber was produced. This pioneer organization, although slow in

developing, has made gratifying progress. It has had to solve problems in many fields simultaneously. For example, it was not possible to concentrate on marketing problems while allowing management practices to deteriorate. Likewise the technical aspects of production have had to be worked out while knotty problems of membership promotion were being solved. Today the association stands nearer its goal of furnishing a complete marketing service for the woodland products of its members than ever before. Management has been placed on a satisfactory basis. The association has gained a favorable reputation in the trade and its products are moving into ever widening market zones. The membership is taking an increasing interest in association activities. Rarely if ever does cutting deviate from the marking. There have been no recent violations of contract and in at least one section of the area served by the association portable mill men offering what appeared to be better than association prices were unable to do any business. However, the problem of membership education remains as one requiring special attention.

Throughout the developmental period the station has worked very closely with the association and has endeavored to help solve its problems in whatever field they might lie. Furthermore, from the outset it has given actual service to the association by carrying on the work of forest inventory and marking of timber to be cut. It does not seem advisable to decrease this aid to the association. In the research field a great deal of data has been collected on all phases of the operation. Much of this information will be of significance chiefly in connection with future development. Therefore, to realize full value from past work it is necessary to continue to maintain very intimate relations with the cooperative. As operations become stabilized it will be possible to shift emphasis to new and radical developments in operating and marketing practices. Furthermore, as current operations of the association require less of the project leader's time, it will be possible to publish reports on a number of subjects for which material is already at hand.

9. Genetics.

Work in forest genetics has proceeded along lines described in our last annual report. Over 7,000 seedlings resulting from controlled pollinations are now growing at the Hopkins Memorial Experimental Forest. Additional seed collected in the fall of 1941 is available for planting this year. Nursery work during the past year was considerably handicapped because of the irregularity and poor quality of C.C.C. labor which resulted in losses of pedigreed stock about 50% greater than in the previous year.

Some progress has been made in the development of a breeding arboretum at the Hopkins Memorial Experimental Forest. Sites for planting of each genus have been staked out and initial plantings

made. Additional stock is being propagated in the nursery for planting in 1942 and subsequent years. Acknowledgement is made for generous cooperation from the Lake States, Pacific Northwest and Northern Rocky Mountain Forest Experiment Stations in obtaining seeds of a large number of species.

In the cooperative tests of racial variation of Norway Spruce sponsored by the International Union of Forest Research Organizations the central European stocks are definitely superior in growth and survival to the trees from Scandinavian seed lots at Williamstown, Massachusetts. However, because of inadequacy of information on the source of seed, conclusions which may be drawn from these test plantings are limited. Cooperative tests of selected red and white pine seed stocks from Ontario, Canada at three state nurseries had to be terminated because the identity of the seed lots was lost in two of the nurseries. However, at the end of the second growing season these seedlings were entirely similar to seedlings grown from local seed.

In the field of cytology studies of chromosome numbers have been continued. Work on the production of seed by unpollinated catkins of birch was hampered by a poor flower crop. Study of cytological features of sterility in red maple suggest that sterility is not a result of pollen tube incompatibility but may be due entirely to genetic or physiological conditions of the pistillate trees themselves.

In the field of physiology major attention continues to be directed at clonal propagation. Cuttings from male trees of red maple rooted on the average to a much greater extent than those from female trees given the same auxin treatment. It is not known whether this is a true sex difference or whether the difference in response is correlated with nutritional factors. It was found that the heat from horse manure placed below the rooting medium in sash beds stimulated a 40% rooting of greenwood cuttings of current season's growth from sugar maple trees more than 60 years of age.

In addition to clonal propagation several physiological leads on techniques which may facilitate breeding work were followed during the year. Prevention of premature flower drop is important in certain specific crosses with white oak where pollen tube penetration is delayed. Spray applications of water solutions of naphthaleneacetic acid were found to delay flower abscission for a considerable time. On the other hand results of spraying to prevent premature dropping of fruit were not conclusive. Preliminary experiments were started to induce flowering in twelve year old white pine trees, working with mechanical methods such as root pruning, branch and stem girdling and branch and stem constriction by wire bands.

Since vitamin B_1 (thiamin) is a very important chemical in tree growth, attempts are being made to correlate the magnitude of its occurrence with vigor of growth. This may provide a method of early

selection of fast growing individuals. Results to date indicate considerable variation in thiamin content of leaves between 10 white pine trees of various growth habits.

Preliminary studies indicate that voltage gradient measurements may be a useful tool in forest genetics research. Fundamentally electrical potential differences (p.d.) between individuals indicate changing internal physiological conditions, and may be used to determine these changes before they are evident externally. For example, preliminary measurements showed a progressive rise in potential differential when red maple flowers were approaching receptiveness, and a sudden drop when the flowers were past receptive. This might be a useful method in determining receptive periods in flowers of such species as oak and hickory where the flowers do not exhibit visible criteria of receptivity.

Storage methods worked out for pine pollen have been found applicable also to spruce. Spruce pollen stored for 17 months at 4° C. and 50 percent relative humidity was still more than 80 percent germinable.

10. Planting.

Although planting was not carried as an active project last year essential work in maintaining the experimental plantings on the Chenango Experimental Forest was done and some useful information was gleaned from rounding up completion of reports on previous work. Thus, technical notes report that germination of red oak acorns prior to sowing is of no benefit in obtaining seedling stands and that injury to emerged radicles on red oak acorns is unimportant in seedling development even if half the emerged radicle is removed. Observation on method and depth of planting plots established in 1933 indicate that any deleterious effects have terminated during the first few years and there is no evidence of deferred or permanent ill effects. Some of the individual red pine trees in this experiment give indication of being resistant to the European pine shoot moth which has been active in the vicinity. The behavior of these trees will be watched for a number of years.

A report of a committee on hardwood planting to the New York Section, Society of American Foresters brought out clearly how little successful reforestation has been done with hardwood. Hardwood planting remains as perhaps the most important question in this field. That shelter during early development may be important was indicated by observations in a number of cases where hardwoods have become established along forest margins or in coniferous plantations after the softwoods had attained sufficient height to significantly modify the local edaphic conditions. Experiments in the establishment of conifer hardwood mixtures at the Chenango Experimental Forest will afford excellent opportunity for testing this thesis since hardwood establishment thus far has been unsatisfactory but the conifers are now reaching a height where the beneficial effect of shelter should begin to make itself felt.

A randomized block experiment laid out to determine the most satisfactory technique for planting hybrid poplar cuttings on sod

land has given results which may have important bearing on the whole question of hardwood planting. It has been known that poplar cuttings could not be grown on sod land without adequate preparation and cultivation during the first growing season. It now appears that preservation of the organic matter by turning the sod under as in plowing is of importance and that successful establishment and growth is not obtained when sod is moved away. At the end of the second year cuttings on blocks on which the sod had been completely turned under and cultivated had attained height more than twice as great as on any of the other treatments.

This and previous experiments by the Oxford Paper Company indicate that cultivation is necessary not primarily to eliminate the competition of sod and weeds for moisture and nutrients but because of some toxic effect of living sod upon the growing trees. Thus, elimination of the initial limiting effect of grass by planting in scalped spots or wide furrows is lost when the tree roots begin to extend out into the adjacent sod area even if the scalped areas or furrows are kept cultivated. Results in this experiment are especially significant because individual variation was completely eliminated by the use of clones. The possibility that certain clones may be inherently better able to withstand sod effects than others was also clearly brought out by the fact that although the two clones used appeared completely identical under nursery conditions the behavior of one in the second year's growth in untouched sod on the check plots was distinctly superior to that of the other. The findings outlined here may have immediate application as a guide to successful results in camouflage plantings for military defense.

PLANS FOR THE COMING YEAR

A prospective cut of major proportions in regular appropriations and the exigencies of the war situation make it clear that plans for the immediate future must be on very restricted basis. To meet this situation the staff is bending every effort to pick up loose ends and round out reports so that as much of the work as possible may be put aside for as long as necessary without too much loss of time and money already expended. No new jobs are to be undertaken except to meet special war needs. However, it will be essential to carry through the work planned for the method of cutting plots in northern hardwoods at the Bartlett Experimental Forest if the timber sale which includes these plots is consummated this season. Although we had looked forward to inauguration of a production cost project and proceeding with at least one series of experimental cuttings on a pilot plant basis in the spruce region it now appears necessary to defer action along these lines. Activities at all field stations will be kept at a minimum and it is planned to maintain a resident superintendent only at the Massabesic and Hopkins Memorial Experimental Forests.

In considering the drastic character of the prospective curtailment of work in the northeast, it should be emphasized that fire, planting and mensuration have all been previously closed out as major station activities. To effect further economies it is necessary to cut deeply into the remaining work in silviculture, genetics and economics. The minimum of essential work in each project may be summarized as follows:

1. Forest Cooperatives. Maintain cooperation with Otsego Forest Products Cooperative Association. Reduce field service in growing stock control to a minimum. Postpone plans for new research and devote energies to completing numerous reports for publication. Complete forest survey for the Cooperstown unit and extend to entire state if special allotment of funds for subsistence expense is granted.

2. Spruce Silviculture. No new work. Concentrate on rounding up reports. Publication of U.S.D.A. Circular on growth on cut-over lands. Consolidate efforts on spruce and northern hardwoods into a single project.

3. Northern Hardwoods Silviculture. To be consolidated with the spruce project. Undertake time cost studies and make tallies of residual stand on large series of harvest cutting plots should logging operations in this area materialize. Complete reports on other work for publication.

4. White Pine Silviculture. Complete report on sunscald study and carry forward these investigations in the field. Complete compilation of manual of white pine silviculture. Carry forward experimental cuttings on the Bartlett Experimental Forest through local sales and with Civilian Public Service work crews if a camp is located at Alfred.

5. Fuelwood Utilization. Assist the Quinebaug Forestry Company in the program for management of its forest properties and in developing improved techniques for producing, delivering and utilizing cordwood. Assist in integration of plans of the Quinebaug Forestry Company with operations of the Yale Forest. Work with Norris-Doxey project forester to spread this forestry program to farm woodland owners in the vicinity. Prosecute research on seasoning of fuelwood, use of mechanical equipment and production costs. Carry through tests of hogged wood as fuel for heating of state institution at Niantic, Connecticut when installation of equipment is completed.

6. Genetics. Take care of hybrid seedlings and arboretum stock and maintain nursery at Hopkins Memorial Experimental Forest. Confine breeding work to genera which bloom so infrequently that it would be inadvisable to miss a good blooming season. Defer further work on cytology. Prepare to reorient work on propagation so as to deal with material useful in camouflage if called upon.

APPENDICES

FOREST PATHOLOGICAL INVESTIGATIONS

Bureau of Plant Industry, New Haven, Connecticut
Dr. Perley Spaulding in Charge

Decays in Living Balsam Fir.

A manuscript for a technical bulletin is practically ready for publication. Some of the salient results of these investigations were given in last year's report. In the meantime a cooperative summary of silvicultural and pathological work has shown that balsam fir should be managed on a much shorter cutting cycle than usually has been done. Suitably handled, much of the present heavy loss by decay and windfall can be avoided. Thus the present dubious status of this increasingly important member of the Northeastern spruce-fir forests can be changed to a more satisfactory one. A technical note has been prepared.

Fire Scar Study.

An opportunity was seized to work in cooperation with the Connecticut State Forester on a study of decay in relation to scars in hardwoods made by a fire 19 years before in a stand about 80 years old at the time of the fire. The species were red and sugar maples; paper, sweet and yellow birches; chestnut, white, red and scarlet oaks; and white ash with smaller numbers of others. A total of about 375 trees were examined. It is expected to correlate linear extent of decay originating at the scar with size and age of scar and the species of tree.

Plantation Disease Survey.

Work on this project was limited to a 3 week's trip in the states of Pennsylvania, Maryland, Ohio and Indiana chiefly to certain plantations known to be in trouble. The examinations included most of the tree species commonly planted in these states. The most serious and widespread trouble of eastern white pine may be called "dwarf-needle disease". It seems to be caused by a poor root system, which in turn may be due to a considerable number of adverse soil conditions. On red pine Tympanis canker was the most serious disease noted. Scotch pine is of extremely doubtful value and will probably be a problem species for many years. No Cytospora canker was found on Norway spruce. The leaf-cast of Douglas fir supposed to be caused by Phaeocryptopus (Adelopus) gäumanni was found on less vigorous trees at York, Pa. Numerous other diseases of minor importance were noted.

Stand Improvement of Northern Hardwoods in Relation to Disease.

Investigation and field experience has continued in cooperation with the C.C.C. during 3 years on the various cankers and decays of the northern hardwoods in relation to stand improvement. This work has been

carried on in New England, New York and Pennsylvania. With the close of the C.C.C. cooperation the results of this work have been summarized and will be issued shortly as an Occasional Paper of the Allegheny Forest Experiment Station.

FOREST INSECT INVESTIGATIONS

Forest Insects Laboratory, Bureau of Entomology
and Plant Quarantine, New Haven, Connecticut
R. C. Brown, Station Leader

The European Spruce Sawfly.

There has been practically no defoliation by the European spruce sawfly in southern New Hampshire and southern Vermont. In the areas which previously were so severely defoliated, it now is difficult to find living cocoons, and on the outskirts of these areas, the infestation has remained very light. In Maine state entomologists have reported larval disease as common in the northern part of the State with a consequent reduction in infestation. In eastern Maine there has been little change from 1940 with generally light to medium infestations. In central Maine (Katahdin section) and western Maine (Rangeley section) there have been moderate increases in infestation at a number of points.

In spite of the reduction in infestation at many of the formerly severely defoliated areas, there are still a number of places where a moderate infestation persists. Many of these are in old growth stands, notably Cornell Mt. in the Catskills of New York, Green Peak and Mt. Equinox in southern Vermont and the Scott's Bog area of Pittsburg in northern New Hampshire. The infestation at Deer Mt. in Pittsburg, N.H., on the other hand, has decreased noticeably since last year. A light infestation also persists in a number of plantations in New York state.

Although the European spruce sawfly infestation in southern New England has remained at a very low level through 1941, there has been an increase in the number of trees dying throughout the previously heavily defoliated area. This is particularly true in stands defoliated in 1936, 1937 and 1938.

Termites and Defense Housing.

Considerable attention has been directed to the termite proofing of dwellings planned for and under construction throughout New York and the New England States by the various federal defense housing agencies. These agencies include the Army, Navy, Air Corps, U. S. Housing Authority, Public Buildings Administration, and Federal Works Agency.

First planning and early construction work by some agencies was begun before the Division of Forest Insect Investigations had knowledge of such activities. Consequently the first buildings were designed and erected with either no consideration for termites or with some consideration for termites but little practical knowledge of cheap and effective protection. Where termites were considered, each housing agency had its own ideas for guarding against them. In some instances superfluous

protection was provided for at one part of a building and neglected in other, often more vulnerable, parts. In other instances ineffective measures were taken, uselessly adding to the construction costs.

Gradually, the suggestions being made by the Division of Forest Insect Investigations to the defense housing agencies are bringing about uniformity in the protection measures. In many instances proper precautions can be taken without increasing costs. Unfortunately, however, to protect buildings of some architectural designs, additional costs are almost imperative. These cases present the real difficulties, since governmental restrictions on dwelling costs necessitate omissions of many, normally necessary items. Thus, in the instances where termite protection means added expense, no matter how small, this protection is not being provided for.

It is becoming more and more obvious that architects, construction engineers, and entomologists must work together and reach agreements on details to develop simple, acceptable, and inexpensive construction practices which will insure adequate protection against termites. As a result of the defense movement it appears that this cooperation and some such changes already are taking place. This movement should not terminate, however, with the ending of the emergency.

Gypsy Moth Investigations.

Ecological studies and investigations on the relation of forest composition to the intensity of infestation were continued in the study areas located in Eastford, Conn., Petersham and Freetown, Mass. and Alfred, Maine. Eight additional areas have been tentatively selected and a survey has been made to determine the egg cluster population in each of them. These areas were selected to represent regions in New England where the gypsy moth is perennially abundant as well as where it seldom or never reaches epidemic proportions. The objective of these studies is to determine the effectiveness of natural factors of control in the two regions.

Saddled Prominent (Heterocampa guttivitta (Walk.)

Reports received indicated that some 8,000 acres or more of beech, maple and birch forests were seriously infested in the White Mountains, N. H., of which some 4,000 acres were almost completely defoliated. In cooperation with the U. S. Forest Service several areas were examined in September to study the injury, to obtain data on the present status of the infestation, and to collect pupae for parasitization records. An average of 59 percent of the pupae had been destroyed by predators in each of three areas examined, and in another area 91 percent had been destroyed. Only a few of the defoliated trees had begun to refoliate prior to September 23rd.

Serious infestations also occurred on Morrick Mountain in Ira, Vermont, where a large area was defoliated in 1940, and also in the vicinity of Marlboro, Vt. However, these areas apparently were not as seriously infested as in 1940. Calosoma frigidum and rodents are important predators on the larvae and pupae of this species.

Eastern Spruce Bark Beetle.

A survey of spruce areas on the White Mountain National Forest in New Hampshire and the Green Mountain National Forest in Vermont indicated a decrease in incidence of attack by the eastern spruce bark beetle (Dendroctonus piceaperda Hopk.). This was particularly true on two areas in New Hampshire where control was practiced during the winter of 1940-1941. On these areas, over 400 infested trees were removed or cut and burned on about 600 acres of virgin timber. Examination of all spruce trees on a permanent sample strip three chains wide and 180 chains long in the Middlebury District of the Green Mountain National Forest in Vermont showed an infestation of 0.111 tree per acre in October 1941 as compared to 0.203 tree per acre in 1940; a decrease of 0.092 infested tree per acre.

European Sawfly Attacking Red and Scotch Pine
Gilpinia frutetorum (F.)

This introduced sawfly has been previously reported from New Hampshire, Massachusetts, Connecticut, New York, New Jersey and in Ontario, Canada. Recent examinations have shown it is also established in pine plantations in East Greenwich and Portsmouth, R. I. Investigations in Connecticut indicate that this sawfly is rather generally distributed in the older red pine plantations through the State, and that the hymenopterous parasite, Microplectron fusciponnis Zett., is firmly established in most of these infestations. This parasite, however, has not been recovered from cocoons collected in Rhode Island.

The infestations in Connecticut, so far as is known, are rather light, except in one red pine plantation on the New Britain Water Shed in Southington. In this plantation the sawfly adults began emerging about the middle of June from cocoons spun in 1940 or earlier, and the emergence continued through the first week of September. Although none of the trees were completely defoliated, the feeding was very noticeable and large numbers of larvae were observed there on the 19th of September, the heaviest feeding having taken place since the first of August. This is contrary to the observations made in Litchfield, Conn., in 1940, where the heaviest feeding occurred prior to the first of August.

Information at hand shows there is one and a partial second generation, with tremendous overlapping of generations each year, and the indications are that a considerable number may remain in diapause through one or more years.

PUBLICATIONS

January 1, 1941 to February 1, 1942

Behre, C. E. Ability of New England Forests to meet increased demands for forest products resulting from war. Journal of Forestry. September 1941.

Belotelkin, K. T., L. H. Reineke and M. Westveld. Spruce-fir selective logging costs. Journal of Forestry (in process).

_____ Skidding in selective logging. Technical Note 40 and Woodland Review, Quebec, Canada. September 1941.

Bratton, A. W. Production of hogged wood from Connecticut hardwoods. Technical Note 41.

Burkholder, P. R. and A. G. Snow, Jr. Vitamin B_1 in trees. Bulletin of Torrey Botanical Club (in process).

Carpenter, R. D. Log purchasing units in northeastern New York State. Technical Note 44.

Duffield, J. W. Review: Stain Technique by W. H, Emig. Journal of Forestry. December 1941.

_____ The cytological basis of forest tree improvement. Journal of Forestry (in process).

_____ Temperature control for microtome knives. Stain Technology. July 1941.

Duffield, J. W. and A. G. Snow, Jr. Effect of storage conditions on pollen longevity of P. Strobus and P. resinosa. Journal of Forestry. April 1941.

_____ Pollen longevity of P. strobus and P. resinosa as controlled by humidity and temperature. American Journal of Botany. February 1941.

Huberman, M. A. Why phenology? Journal of Forestry. December 1941.

_____ Review: The social relations of science, by J. G. Crowther. Journal of Forestry. April 1941.

_____, G. R. Condit and John R. McGuire. Collect the Bounty on your wolf trees. Technical Note 45 and Journal of Forestry (in process).

Jensen, V. S. Pulpwood production costs on small operations in the upper Connecticut River Valley. Journal of Forestry. December 1941.

_____ Hurricane damage on the Bartlett Experimental Forest. Technical Note 42.

_____ Eight years growth in hardwood stands on the Bartlett Experimental Forest. Technical Note 43 and Pulp and Paper Magazine of Canada. December 1941.

Reineke, L. H. Fruiting of 10-year old conifers. Technical Note 47.

_____ A new increment core instrument and coring wrinkles. Journal of Forestry. March 1941.

_____ Effect of stocking and seed on nursery development of eastern white pine seedlings. Journal of Forestry (in process).

_____ Effect of pregermination and radicle damage on first year development of red oak. Journal of Forestry (in process).

Recknagel, A. B. and M. Westveld. Progress report on Lot 7 methods of cutting plots. Journal of Forestry (in process).

Rulison, D. E. Specifications and instructions for use of the spray gun for marking timber. Technical Note 48.

Schreiner, E. J. and J. W. Duffield. Metaxenia in an oak species cross. Journal of Heredity (in process).

Snow, A. G. Variables affecting vegetative propagation of red and sugar maple. Journal of Forestry. April 1941.

_____ White pine propagation. Journal of Forestry. March 1941.

_____ Effect of indolebutyric, indoleacetic, and naphaleneacetic acids on rooting of red maple cuttings. Technical Note 46.

_____ Effect of needle removal on survival of white pine cuttings. Technical Note 38.

Spaulding, Perley, M. Westveld and R. Hansbrough. Balsam fir -- Use it, don't lose it. Technical Note 49.

Stickel, P. W. — On the relation between bark character and resistance to fire. Technical Note 39.

Westveld, M. — Yield tables for cutover spruce-fir stands in the northeast. Occasional Paper 12.

_____ — Some effects of incomplete girdling. Journal of Forestry (In process).

_____ et al — A silvicultural policy for the hurricane area. Committee on Silviculture, New England Section, S.A.F. Journal of Forestry. April 1941.

_____ et al — Recommended Forest practices for New England. Committee on Silviculture, New England Section, S.A.F. Forestry Chronicle. December 1941.

_____ — Reviews: Site type and rate of growth at Lake Edwards Forest Experiment Area, by R. G. Ray

Forest site classification and soil investigations on Lake Edwards Forest Experiment Area, by C. C. Heimberger.

Cleaning of scattered young Balsam fir and spruce in cutover hardwood stands, by G. A. Mulloy.

Improvement cuttings in intolerant hardwood conifer types, by G. A. Mulloy.

All of the above issued by Dominion Forest Service, Ottawa, Canada. Reviews in process, for Journal of Forestry.

PERSONNEL

Northeastern Forest Experiment Station
1941

ADMINISTRATION

C. Edward Behre	P-6	Director
F. S. Martin (1 mo.)	CAF-9	Senior Administrative Asst.
Mary E. Turrell (11 mo.)	CAF-6	Principal Clerk
Julia J. Braun	CAF-4	Clerk-Stenographer
Marian M. Thomas	CAF-4	Clerk-Stenographer
Ruth B. Baum	CAF-3	Asst. Clerk-Stenographer
Helen M. Wienhusen (9 mo.)	CAF-3	Asst. Clerk-Stenographer
John A. Kirchner (2 mo.)	CAF-2	Junior Clerk-Typist

FOREST MANAGEMENT

Raymond F. Taylor	P-5	Senior Silviculturist
Mary C. Weldon	CAF-5	Senior Clerk
Marguerite M. O'Neill (5 mo.)	CAF-3	Asst. Clerk-Stenographer
Helen M. Wienhusen (3 mo.)	CAF-3	Asst. Clerk-Stenographer

Silviculture

M. Westveld	P-5	Senior Silviculturist
M. A. Huberman (10 mo.)	P-5	Associate Silviculturist
Victor S. Jenson	P-3	Associate Silviculturist
Arthur C. Hart (6 mo.)	P-1	Junior Forester
Kalervo N. Lahi (8½ mo.)	P-1	Junior Forester
George R. Trimble, Jr. (7 mo.)	P-1	Junior Forester
Gordon R. Condit (4 mo.)	SP-5	Agricultural Aid
Richard C. Desmond (5 mo.)	SP-5	Agricultural Aid
John R. McGuire (2 mo.)	SP-5	Agricultural Aid
Carlisle R. Saxton (2 mo.)	SP-5	Engineering Draftsman
Paul E. Bruns (6 mo.)	SP-4	Assistant Agricultural Aid
Arthur A. Poling (1 mo.)	SP-4	Assistant Agricultural Aid
Joseph A. Sachor (1 mo.)	SP-3	Junior Agricultural Aid
Roger P. Sloan (2½ mo.)	SP-3	Junior Agricultural Aid
James S. Marsh (1½ mo.)	SP-2	Under Agricultural Aid

Mensuration

L. H. Roincke	P-2	Assistant Silviculturist

Forest Genetics

Ernst J. Schreiner	P-4	Silviculturist
Albert G. Snow, Jr.	P-2	Assistant Plant Physiologist
John M. Duffield	P-1	Junior Forest Ecologist
Theodore F. Breon (7 mo.)	SP-6	Senior Agricultural Aid(Forestry)
Harold F. Ford	SP-4	Assistant to Technician
Stephen P. Lawler (1½ mo.)	SP-4	Assistant Field Assistant

FOREST ECONOMICS

E. Phil Brandner (1 mo.)	P-5	Senior Forester
Charles R. Lockard	P-4	Forest Economist
Marlyn B. Dickerman (1 mo.)	P-2	Assistant Forester
Roland H. Ferguson (4 mo.)	P-2	Assistant Forester
John H. Rudo (6 mo.)	P-1	Junior Forester
Donald E. Rulison	P-1	Junior Forester
J. Willcox Brown (4 mo.)	SP-5	Agricultural Aid
Harry B. Price (6 mo.)	CAF-5	Assistant Clerk-Stenographer
Zigmund S. Poreda (7 mo.)	CAF-2	Junior Clerk-Typist
Francis V. Lupia (3 mo.)	Unall.	Agent (Jr. Agr. Aid)

FARM FORESTRY

Connecticut

Allen L. Bratton	P-2	Assistant Forester

New York

Roswell D. Carpenter (3½ mo.)	P-2	Assistant Forester

FOREST FIRE COOPERATION

Taxation and Insurance

Harold D. Shepard (6 mo.)	P-5	Senior Forest Economist

RS-NE
SILVICULTURE
Harvest Cuttings
Spruce-Fir
(M-1)

February 1, 1942

METHODS OF CUTTING IN THE SPRUCE-FIR REGION

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Harvest cuttings: Spruce types.

4. Purpose: To determine best regeneration methods and cutting techniques for developing all-aged spruce stands best suited to integrated pulpwood and sawtimber production.

5. Review of past work: The technique for regenerating the commonly occurring spruce stands having an abundance of advance reproduction has been developed. Successful management consists mainly in protection of young growth from logging damage, subsequent windthrow, fire, and from excessive shading and crowding by hardwoods. In pure or nearly pure spruce-fir stands removing 1/4 to 1/2 the stand 10 to 15 years previous to the final cut results in good reproduction. Inadequate softwood reproduction in stands containing strong admixtures of northern hardwoods involves a problem not yet solved. Changed seedbed conditions, dense hardwood sprouts, and invading brush growth discourage spruce and fir reproduction following cutting of spruce stands. Weedings are necessary to maintain spruce and fir in competition with hardwoods which invade old-field spruce cutover areas. Partial cutting is just as economical as clearcutting for a given skidding distance in second growth spruce-fir stands.

6. Accomplishments during past year: Initiated and completed first phase of study of logging damage under partial cutting. Paper being prepared. Completed large set of new partial cutting plots and established and logged a small set in pure spruce for show window demonstration. Located possible areas for future studies on pilot plant basis.

7. Plans for next year: Establishment of new partial cutting plots where possible to get logged in near future. Assist private and state trials of partial cutting. Publications and reports. Cooperation on time and cost studies which may be handled by a separate section on cost phases of silviculture, if funds allow.

8. Date of completion: Continuous.

9. Assignment: M. Westveld

RS-NE
SILVICULTURE
Harvest Cuttings
Northern Hardwoods
(M-4)

February 1, 1942

METHODS OF CUTTING IN NORTHERN HARDWOODS

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Harvest cuttings: Northern hardwoods.

4. Purpose: To determine the relative merits of clear cutting, tree selection, and group selection cutting methods in the northern hardwoods types.

5. Review of past work: Over a 7-year period a series of five 5-acre plots in many-aged northern hardwood types were cut selectively, removing 25 percent to 35 percent of the basal area. Comparison plots were clear cut during three successive years. On a comparable 80-acre block group selection cuttings involve the clearing in small openings of about one-eighth of the total area.

Five years after selection cutting net growth on treated areas about same as in untreated stands. However, in selectively cut stands increment is being laid on individuals holding greatest promise of producing valuable sawlogs. In general residual sugar maple, white ash, beech, and red maple are making excellent growth while yellow birch showed net loss as mortality more than offset growth of living trees.

Windfirmness in northern hardwoods largely depends on crown canopy, uneven-aged stands being less firm than even-aged stands. Immediately following partial cutting, stand is particularly vulnerable to wind damage but this condition is gradually overcome as residual trees develop and crown canopies close. Dominant trees in stand, because of their exposed tops, and sprout clumps which usually have abnormally large crowns are more susceptible to windthrow than less exposed trees with smaller crowns.

Growth percent in untreated northern hardwood stands depends largely on tree size and species composition. Under favorable growing conditions the volume of 5-inch trees increases three times as fast as that of 18" trees. Red maple, beech, paper birch, and eastern hemlock ordinarily grew more rapidly than yellow birch, sugar maple, white ash, and red spruce.

A series of 15 sample plots, each 3 acres in area in 100-acre tract of all-aged northern hardwoods await cutting. Plots are marked for selection cuttings of four degrees, together with a check, replicated three times.

6. Accomplishments during past year: Cutting operations completed on an additional 20-acre group selection area. After 1941 growing season 5-year remeasurements were obtained on fourth 5-acre selection plot, also 5 year data on first series of group cutting plots. Reports and technical notes prepared on 8 years development of northern hardwood stands, hurricane damage on the Bartlett Experimental Forest and establishment and development of reproduction following clear and selective cutting in many-aged northern hardwoods. Compilation and statistical analysis of residual stand growth data following various degrees of removal largely completed.

7. Plans for next year: Publications on development of reproduction following removal of overstory under tree selection and clear cutting; and on growth of residual stands following different degrees of cutting. Time-cost studies will be undertaken on the series of 15 methods of harvest cutting plots, provided cutting program materializes in 1942.

8. Date of completion: Indefinite.

9. Assignment: Jensen (Silviculture phase may be assigned elsewhere if section on cost phases of silviculture is set up in 1942 with Jensen in charge).

RS-NE
SILVICULTURE
Harvest Cuttings
White Pine
(M-3)

February 1, 1942

METHOD OF CUTTING IN WHITE PINE REGION

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Harvest cuttings: White pine types.

4. Purpose: To refine knowledge of relative merits of different harvest cutting methods in white pine types with especial reference to definition of optimum growing stock, and evaluation of factors affecting natural reproduction.

5. Review of past work: Previous work by other agencies in the region has been evaluated in problem analysis for this project. Station has analyzed data from numerous permanent plots some of which date back to 1906 and studied a tract in Maine repeatedly partially cut during past 3 generations.

6. Accomplishments during past year: Made off-schedule 7-year remeasurement of partially cut and clearcut Deering plots and presented results at field meeting of York County Farm Forest Products, Inc.; assisted in training of Forester for above cooperative.

Established cutting plots in mature pine-hemlock and in old-field pine, marked them, and made timber sales. Continued cruising and establishment of cruise plots at Massabesic until CCC Camp closed November 1.

Completed manuscript on "Blister Rust Control in White Pine Woodland Management" in cooperation with Blister Rust Control Office. Submitted outline for bulletin on "Handling White Pine Woodlands" to white pine authorities in region. Prepared paper with Taylor and Extension Forester Nutting on "Repair your woodlot" based on tract repeatedly partially cut. Completed paper on "pure vs. mixed stands in white pine types", with Professor Hawley, to be withheld from publication for the present.

7. Plans for next year: Complete bulletin on "Handling White Pine Woodlands". Prepare management plans for Massabesic Experimental Forest. Establish additional harvest cutting plots. Somewhat indefinite due to labor situation and possible emergency war work.

8. Date of completion: Indefinite.

9. Assignment: M. A. Huberman.

RS-NE
SILVICULTURE
Stand Improvement
Spruce-Fir
(M-1)

February 1, 1942

STAND IMPROVEMENT IN THE SPRUCE-FIR REGION

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Stand improvement in spruce types.

4. Purpose: To develop measures for increasing the production and growth rate of spruce and fir, and improving the quality of growth.

5. Review of past work: Girdling of defective overtopping hardwoods, shown to be an economical and effective method of increasing growth rate of spruce, widely adopted as a measure of stand improvement. Thinning of old-field spruce stands also shown to be a practical measure for increasing annual increment. Experiments in weeding of young spruce stands on cut-over areas and of thinning at later stages are under way. Selective pruning of crop trees to improve the quality of sawtimber yield is also in progress. Elimination of undesirable tree growth from planting sites, plantations, and stands of natural reproduction by poisoning and girdling has been studied. Poisoning, while killing the trees, often fails to prevent subsequent sprouting or root suckering. With aspen, girdling without notching is most effective in eliminating root suckers.

6. Accomplishments during past year: Data on hurricaned plots checked over for information on wind damage. Small pruning experiment started in white spruce plantation. Final work on girdling plots showed that notching should be employed only on trees with infolding seams as it is costly; peeling should be used during bark slipping period; double hacking where only inefficient labor available.

7. Plans for next year: Studies in weeding and thinning will be continued, if time permits. New thinning plots to be established if opportunity presents itself. Summary of spruce swamp drainage experiment to date.

8. Date of completion: Continuous.

9. Assignment: Westveld and Trimble.

RS-NE
SILVICULTURE
Stand Improvement
Northern Hardwoods
(M-4)

February 1, 1942

STAND IMPROVEMENT IN NORTHERN HARDWOODS

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Stand improvement in Northern Hardwoods.

4. Purpose: To determine the effects and feasibility of thinnings, weedings, and mowings in the development of northern hardwood stands.

5. Review of past work: In a thinning experiment initiated in 1932 involving instrumental records of changes in environmental conditions, some yellow birch showed signs of decadence after the second growing season but otherwise appeared thrifty and are developing satisfactorily. On the basis of 5-year records, the residual stand as a whole increased in volume about 4 percent annually; even yellow birch in spite of losses from exposure showed an increase in net volume three times as great on the thinned as on the check area. Evaporation and wind movement at first increased more than 50 percent as a result of the heavy thinning but again approached normal as the stand closed.

Weeding in northern hardwood stands does not appear to appreciably stimulate the height and diameter growth of favored crop trees. The more valuable northern hardwood species, sugar maple, white ash, and birch, are aggressive in sapling stands and in spite of keen competition with the more rapidly growing intolerant species, such as pin cherry and aspen, will ordinarily survive to make up a well stocked stand. If they occur in quantity, red maple sprout clumps are a more serious threat to the development of a new high quality stand. The practicability of weeding many young northern hardwood stands would, therefore, seem open to question.

However, if weeding is undertaken in northern hardwood stands, a light cutting, removing only stems actively competing with the selected crop trees, is not only economical but more satisfactory than a heavy release, as the likelihood of snow damage is reduced. Complete and partial severance, whether low or a couple of feet above ground line, appear equally effective. Weed trees were readily killed by barking and injecting sodium arsenite, although this method

seems more time-consuming than cutting, and as weeding does not open up a stand sufficiently to induce sprouting; poisoning had no compensating advantages.

Mowing in conjunction with harvest cuttings has been highly satisfactory from the silvicultural standpoint as stagnating, crooked advance reproduction is converted to a fast growing stand of straight saplings. Whether or not these advantages are maintained and financially justified has not as yet been determined.

6. Accomplishments during past year: After the 1941 growing season, 5-year remeasurements were obtained on two 5-acre thinning plots. Two experimental thinning areas to supplement those damaged by the hurricane were selected and preliminary work completed during the past year. A progress report was prepared covering the 5-year results of a weeding experiment.

7. Plans for next year: Report on stand development in 5 years after a light and moderate thinning. Treatment of the recently selected experimental thinning area will be completed in 1942 if labor available.

8. Date of completion: Indefinite.

9. Assignment: Jenson, for time being. If cost phase of Silviculture Section set up will be assigned otherwise.

RS-NE
SILVICULTURE
Stand Improvement
White Pine
(M-3)

February 1, 1942

STAND IMPROVEMENT IN WHITE PINE

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Stand improvement: White pine types.

4. Purpose: To refine and test measures to increase increment, quality, and volume production of white pine types, as determined by previous work of other agencies.

5. Review of past work: Work of Yale, Harvard, Syracuse, and other agencies in thinning, weeding, release cuttings, and pruning, plus many permanent sample plots begun in 1906 and additional areas on Massabesic Forest provide basis for project. Analysis completed of data from old permanent sample plots which have been remeasured regularly.

6. Accomplishments during past year: Established experiments at Massabesic in methods of improvement and release cutting, and sold stumpage to get them cut. Marked and sold fuelwood stumpage in north unit as beginning of management of that tract. Cooperated in gypsy moth experiments with Bureau of Entomology. Wrote work plans for silvicultural control of Gypsy Moth experiment and for other research started. Completed short term study of wolf pines and published preliminary results as Technical Note. Article for Journal of Forestry on same subject accepted.

7. Plans for next year: Installation of additional research plots, particularly on thinning and release cutting, completion of measurements on others; prosecution of improvement cuttings in northern unit. Cooperation with entomology, blister rust and wildlife research. Complete manuscript for white pine bulletin.

8. Date of completion: Indefinite.

9. Assignment: M. A. Huberman.

RS-NE
SILVICULTURE
Silvics
Spruce-Fir
(M-1)

February 1, 1942

SLASH STUDIES IN THE SPRUCE REGION

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Silvics: Ecology of slash in spruce types.

4. Purpose: To determine the effect of slash on reproduction and the rate of slash decay and its relationship to the protection of forests from fire.

5. Review of past work: Dense softwood slash not only kills advance reproduction beneath it but effectually prevents the establishment of new reproduction for a period of 15 to 20 years. Hardwood slash rarely hinders reproduction seriously for more than five or six years. The rate at which slash decomposes varies greatly with respect to species, as well as size of material. Beech, birch, and maple slash decomposes from two to three times as fast as spruce and fir. Studies of spruce slashings indicate that spruce slash persists as an abnormal fire hazard for an unexpectedly long period. From 15 to 20 years or more must transpire before spruce slashings may be considered safe.

6. Accomplishments during past year: The third successive 5-year measurement of a set of 3 major slash plots was completed, and analysis begun in preparation for manuscript in cooperation with Pathology.

7. Plans for next year: Analysis to be completed and comprehensive report on both the pathological and silvicultural phases of the study made.

8. Date of completion: 1943 or later depending on emergency war work.

9. Assignment: P. Spaulding, J. R. Hansbrough and M. Westveld.

RS-NE
SILVICULTURE
Silvics
White Pine
(M-3)

February 1, 1942

ECOLOGICAL FACTORS OF WHITE PINE TYPES
(formerly Sunscald study in White Pine)

1. Field division: Forest Management.

2. Work project: Silviculture.

3. Line project: Silvics: Ecological factors.

4. Purpose: To evaluate ecological factors affecting establishment, growth and development of regeneration in white pine types.

5. Review of past work: Considerable work on site factors affecting regeneration, on slash disposal effects, and on other phases has been done by Harvard, Yale, Vermont, and other agencies.

6. Accomplishments during past year: Studied sunscald on white pine by making reconnaissance of occurrence of injury, by establishing plots in which trees were exposed in July, in December, and left unexposed using screens of several degrees of shade, at the Massabesic Forest. Cambial temperatures were taken in summer and winter at Maltby Lake, Connecticut. Samples of injured trees have been obtained for microscopic study. Computations are completed.

A paper on "Why Phenology" was published in the Journal of Forestry.

Established two areas of ploughed furrows to test distance and direction as factors in effectiveness of natural seeding from white pines laden with cones.

Advised on work of private owners in direct seeding in recently burned over plantations in Massachusetts. Cooperated with Genetics project, in study of single parent progeny of white pine.

7. Plans for next year: Complete sunscald study by preparation of thesis. Prepare report on seeding effectiveness. Initiate regeneration studies on slash-area in stripped lot now a part of Massabesic Forest.

8. Date of completion: Continuous, although individual studies will be reported on at short intervals; e. g. Sunscald in 1942.

9. Assignment: M. A. Huberman.

RS-NE
MENSURATION
Tree Studies
(ME-3)

February 1, 1942

VOLUME TABLES FOR SPECIES IN WHITE PINE TYPES

1. Field division: Forest Management.

2. Work project: Mensuration.

3. Line project: Tree studies: Volume tables for species in white pine types.

4. Purpose: To prepare volume tables, in cooperation with University of Maine, for white pine, hemlock and various species of hardwoods used for fuel.

5. Review of past work: Available volume tables for white pine and hemlock appear inadequate for utilization standards of southern Maine.

6. Accomplishments during past year: Assembled and collected remeasurements on almost 400 white pine trees, sent to Professor D. B. Demeritt of University of Maine, who has completed a preliminary Maine rule volume table. Measurements on some 50 hemlock trees taken, sent to Demeritt for inclusion with his data for tables of this species. Measurements taken on a number of hardwood trees, for fuelwood cordwood tables.

7. Plans for next year: Completion and publication of white pine volume tables by number of logs and total height for International $\frac{1}{4}$ inch, Scribner Decimal C, and Maine Rule. Collect additional hemlock measurements to permit construction of similar tables. Construction of fuelwood volume tables for all hardwoods, lumped together, in cords and in cubic feet.

8. Date of completion: Probably 1944.

9. Assignment: M. A. Huberman, in cooperation with Professor D. B. Demeritt of University of Maine.

RS-NE
MENSURATION
Stand Studies
(NE-2)

February 1, 1942

GROWTH AND YIELD OF SPRUCE AND FIR

1. Field division: Forest Management.

2. Work project: Mensuration.

3. Line project: Stand study -- spruce and fir growth and yield.

4. Purpose: To prepare normal yield tables for even-aged second-growth stands of red spruce, pure and in mixture with balsam fir, to determine the approach to normality of understocked stands; to provide a basis for prediction of growth of spruce and fir on cut-over lands; and to prepare tables of growth which will be applicable over the whole spruce region of the Northeast.

5. Review of past work: U.S.D.A. Bulletin No. 142 was published in 1929, giving tables of yield for fully stocked, even-aged, second-growth stands of spruce and fir. Eighteen sample plots are being maintained in New Hampshire and Vermont to check these tables and to provide information on mortality, change in composition, and rate at which understocked stands approach normality. Six additional plots were abandoned because of hurricane damage. A special analysis of growth in northern Vermont and New Hampshire was made in 1936 for the Coos-Essex cooperative sustained-yield project. Data from some 400 plots on cut-over lands have been analyzed statistically to derive a mathematical expression for the volume of spruce and fir on cut-over lands, as a function of time since cutting, density (as indicated by the relation between number of trees and their average diameter), and composition (as indicated by the proportion of the total number of trees represented by spruce and fir).

6. Accomplishments during past year: Remeasurement of 16 plots, added to previous work formed the basis for issuing spruce-fir yield tables, one set for dominant softwood sites, another for secondary softwood sites.

7. Plans for next year: Complete manuscript for bulletin on growth and yield of cutover spruce-fir stands.

8. Date of completion: Even-aged phase indefinite. Cut-over spruce-fir lands phase, 1942.

9. Assignment: M. Westveld.

RS-NE
MENSURATION
Stand Studies
(ME-3)

February 1, 1942

GROWTH AND YIELD OF NORTHERN HARDWOODS

1. Field division: Forest Management.

2. Work project: Mensuration.

3. Line project: Stand studies, composition, growth, mortality, and yield of northern hardwoods.

4. Purpose: To provide the factual information required as to kinds, sizes, and quantities of forest products which will be produced within a given period of time so that forest management can be directed toward maximum value return under sustained yield handling of northern hardwood stands.

5. Review of past work: Fifty-two permanent plots and 114 extensive plots established in Maine, New Hampshire, Vermont, and New York, have all been remeasured once. Records covering 30 years are available for a number of plots. The 1932 survey of the Bartlett Experimental Forest plus some 5,000 cores from 128 plots measured for the Coos-Essex and Tioga cooperative projects provide basic data for growth prediction. A special study of mortality on a large number of the 1932 plots provide data not hitherto available for growth prediction in northern hardwoods. An increment core examining device for field or office use for examining cores by transmitted light has been patented. A system for accumulating mortality and disintegration data has been instituted. Data on hurricane damage analyzed.

6. Accomplishments during past year: Report on standards for growth prediction not completed.

7. Plans for next year: Study to be shelved temporarily until work of higher priority finished. Project leader transferred. Growth prediction report to be handled by Taylor and Westveld.

8. Date of completion: Indefinite.

9. Assignment: None.

RS-NE
REGENERATION
Planting
(F-1)

February 1, 1942

PLANTING

1. Field division: Forest Management.

2. Work project: Regeneration.

3. Line project: Planting.

4. Purpose: To determine most desirable types of planting and to devise techniques that will improve plantation survival and growth.

5. Review of past work: Regional survey of plantations conducted in 1931 and 1932. Study of relation of method and depth of planting to survival and ultimate development initiated in 1932. Tests of the constancy of racial characteristics under differing environmental conditions were initiated as cooperative effort in 1932, using a single strain of Scotch pine. Establishment of mixed conifer-hardwood plantations was begun with strip mixtures in 1933 and with groupwise arrangements in 1935. Poisoning of undesirable tree growth was tested, with results none too satisfactory. Direct seeding of hardwoods, on sod land, in furrows, seed spots, and on sod showed promise only for sugar maple and red oak. A floristic study of wet areas was made in 1935, with field tests of species and stock for planting such areas. Nursery tests on density of sowing of coniferous seed, begun in 1936, showed value of lighter densities for producing better stock. Outplantings of stock grown at various densities have been made. Experiments were initiated in 1938 in the establishment of rooted and non-rooted cuttings of five clones of hybrid poplars. Deferred planting of hardwoods in the mixed-species plantings were begun in 1939. A test of root-proliferation as an aid to hardwood establishment was made in 1939. A study established at Hopkins in 1940 (as part of the genetics research) has demonstrated that hybrid poplars cannot be successfully established on grass land without adequate site preparation followed by cultivation during the first growing season.

6. Accomplishments during past year: General scrutiny of results to date showed: (a) that conifer-hardwood mixtures have not been satisfactory because hardwoods have had to be replaced. Successful method of establishment not developed.

(b) All minor experiments completed except wet area planting which consists merely of observations on species planted, and scotch pine seed source experiment which has been turned over to Genetics.

Nothing new started and all overdue reports completed. Experiments on density of sowing in nursery, oak radicle mutilation, and a phase of the methods and depths of planting study located in Connecticut, were reported on.

7. Plans for next year: To hold the Chenango Forest in present status without a superintendent. Check on hardwood survival and arrange if possible for planting remainder of hardwood mixtures in 1943. If possible begin test of methods of planting hardwoods by compact experiments at Hopkins. If funds for planting project leader not likely in next five years, recommend dropping project entirely and turning Chenango back to New York state. The results of the hybrid poplar site-preparation study will be prepared for publication.

8. Date of completion: Indefinite.

9. Assignment: R. F. Taylor.

RS-NE
GENETICS
Field Tests

February 1, 1942

FIELD TESTS--NEW HYBRID POPLARS

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Field tests--Oxford hybrid poplars.

4. Purpose: To determine the adaptability of the Oxford hybrid poplars throughout the United States.

5. Review of past work: Cuttings of 58 selected hybrid clones have been distributed to 25 cooperating Forest Service, Soil Conservation Service, Bureau of Plant Industry, and state nurseries throughout the United States. Cuttings have also been sent to government agencies in South America. It is apparent from these cooperative nursery tests that the growth and development of a hybrid in any particular region cannot be predicted but must be based upon actual field tests in that region. Some cooperators have used those hybrids which appeared to be the best for their region in plantation tests.

6. Accomplishments during past year: No new cooperators were added during the past year. Two Soil Conservation Service nurseries requesting additional hybrids for nursery tests were supplied with cuttings. Some of the cooperators have reported excellent success with a number of these hybrids; others have apparently handled these cooperative tests inadequately.

7. Plans for next year: Analysis of data on nursery and field trials submitted by cooperators during the past year.

8. Date of completion: Final conclusions should be based on data from 10- to 15-year-old plantations.

9. Assignment: E. J. Schreiner.

RS-NE
GENETICS
Breeding

February 1, 1942

BREEDING AND INHERITANCE--FOREST TREES

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Breeding and inheritance.

4. Purpose: Controlled breeding for the production of improved forest trees and for information on inheritance in forest-tree species.

5. Review of past work: A total of over 5,000 seedlings resulting from controlled pollinations previous to 1941 on Acer, Betula, Fraxinus, Liriodendron, Magnolia, Ostrya, Pinus, Quercus, and Ulmus are now growing in the nursery at the Hopkins Memorial Forest. The breeding work has produced evidence for the occurrence of dichogamy in many forest species and self-incompatibility in individual trees. In Betula species some viable seed is produced without pollination (apomixis).

6. Accomplishments during past year: A large number of seedlings were obtained from crosses between Acer saccharinum and Acer rubrum. Breeding with Betula was limited because of the large number of seedlings now in the nursery. Fraxinus americana produced a few seed to controlled pollination, but controlled breeding on Magnolia acuminata failed completely. Breeding with Populus was limited to crosses between the Oxford hybrids; many second-generation seedlings (some representing 6-species hybrids) are now growing in the nursery from seed produced in the spring of 1941. Intra-specific cross-pollination on white oak has solved the problem of adequate breeding technique for this species. Close-pollination on three species of Ulmus indicated self-compatibility in all species.

7. Plans for next year: In view of the necessary retrenchment in temporary and permanent personnel it is anticipated that controlled breeding will be kept to a minimum (possibly omitted entirely) in the spring of 1942.

8. Date of completion: Indefinite

9. Assignment: E. J. Schreiner, A. G. Snow, Jr. and J. W. Duffield.

February 1, 1942

INDIVIDUAL VARIATION

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Variation in percent sugar in the sap of sugar maple.

4. Purpose: To investigate the extent of inherent variation of percent sugar and to discover trees in which percent sugar is consistently high.

5. Review of past work: Past work indicates probable inherent variation in percent sugar in the sap of hard maple. Variation within the same tree (throughout the day and around the circumference) is less than the difference between the lowest and highest trees. Previous to 1941 the sap from trees tapped at the Hopkins Memorial Forest varied from 1 percent to slightly over 4 percent in sugar content.

6. Accomplishments during past year: In the spring of 1941--apparently an abnormal sugar year--the sap of the individual trees tested at Hopkins varied from 2 to 10 percent in sugar content. This may have been the result of abnormal weather conditions. The individual trees showed approximately the same relative variation in sugar content as in previous years.

7. Plans for next year: The trees which were tested in the spring of 1941 will again be tapped in 1942 to determine their relative behavior.

8. Date of completion: Preliminary selection for inherent variation in sugar content may be possible after the 1942 tests. Final conclusions will be based on controlled progeny tests and on tests of selected clones grown on different sites.

9. Assignment: E. J. Schreiner and H. F. Ford.

February 1, 1942

RACIAL VARIATION

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Seed source investigations

4. Purpose: To evaluate strains or varieties of native and exotic species on the basis of their forest and use possibilities in the Northeastern region.

5. Review of past work: In 1938 seed of red and white pine from Ontario was distributed to the state nurseries at Saratoga, New York; Amherst, Massachusetts; and Gerrish, New Hampshire. At the end of the second growing season these seedlings were entirely similar to those grown from local seed in the respective nurseries. Fourteen lots of Norway spruce were planted at Hopkins Memorial Forest in the spring of 1940 as part of the cooperative tests sponsored by the International Union of Forest Research Organizations. At the end of the first year in the seed bed some of these seed lots showed highly significant differences in quantitative and qualitative characteristics.

   In 1932 and 1934 plantations of stock derived from the Boonville Scotch Pine stand were established in a number of locations throughout New England to determine the effect of different climates on the growth of trees of a single seed origin derived from straight parents.

6. Accomplishments during past year: The red and white pine seedlings grown by cooperating nurseries have either been distributed for planting or the identity of the lots has been lost. Individual height measurements have been taken on the Norway spruce seedlings.

7. Plans for next year: If the red and white pine seedlings can be located, continuing observations will be undertaken. The Norway spruce seedlings will be set out in transplant beds at the Hopkins Forest.

   Routine 5-year reexaminations of the Booneville Scotch Pine plantations will be made in order to study development of stem form.

8. Date of completion: These investigations will be continued from year to year as seed of important forest species becomes available.

9. Assignment: E. J. Schreiner and H. F. Ford.

RS-NE
GENETICS
Cytology

February 1, 1942

CYTOLOGY--CHROMOSOME INVESTIGATIONS WITH FOREST TREES

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Chromosome investigations with forest trees.

4. Purpose: Determination of the chromosome number of species and individual trees used in breeding.

5. Review of past work: A chromosome number reconnaissance of *Quercus* species of potential use in breeding has been completed. Chromosome number determinations have been made in several species of *Acer*, a genus in which polyploidy occurs.

6. Accomplishments during past year: Study of *Acer rubrum* material collected by Southern and Lake States Stations showed that trees in Mississippi and Michigan have 78 chromosomes in somatic tissue, while a tree used for breeding in New Haven has 104 chromosomes. A brief article on this work has been submitted for publication in *Chronica Botanica*. *Acer macrophyllum* was found to have 26 chromosomes, and *Fagus sylvatica*, *F. grandifolia*, and hybrids between them were found to have 24 chromosomes. Material for the study of the chromosomes of about 25 Oxford Hybrid Poplar clones has been collected but not yet studied.

7. Plans for next year: If personnel is available, chromosome number determinations will be continued with emphasis on the genera *Betula* and *Acer* in which polyploidy is rather common, and on progenies derived from interspecific crosses in these genera as an aid in verifying hybridity. An attempt will be made to extend the study of polyploidy in *Acer rubrum*.

8. Date of completion: Chromosome number investigations of parent trees and hybrids will be continued from year to year.

9. Assignment: J. W. Duffield.

RS-NE
GENETICS
Cytology

February 1, 1942

CYTOLOGY--REPRODUCTION IN FOREST TREES

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Cytological aspects of reproduction in forest trees.

4. Purpose: To obtain information on the cytological phases of reproduction essential to research in heredity and variation.

5. Review of past work: Apomictic seed has been found in about 2 percent of non-pollinated fruits of Betula papyrifera, and the chronology of embryo development in this species and in B. lutea has been outlined.

6. Accomplishments during past year: Due to lack of flowering little work was done with Betula papyrifera in 1941. Considerable individual tree variation in seed filling was found in Betula populifolia, and material was collected for a study of individual tree variation (in apomixis) in this species. Cytological studies of seed formation in fertile and sterile pistillate trees of Acer rubrum have been started with a view to determining the cause of sterility of certain trees. Results to date suggest that pollen-tube incompatibilities are not a significant factor in this case.

7. Plans for next year: If personnel is available, the study of apomixis in Betula will be continued and its scope broadened to determine specific and individual variation in degree of apomictic reproduction. The results should constitute a basis for estimating the proportion of presumably hybrid birch seedlings derived from controlled breeding which may in reality be of apomictic origin. Pollen-tube penetration studies will be conducted if the breeding work affords opportunities.

8. Date of completion: The study of apomixis in Betula should be completed within 2 years. Pollen-tube penetration studies will be continued as problems involving incompatibilities arise.

9. Assignment: J. W. Duffield.

RS-NE
GENETICS
Physiology

February 1, 1942

PHYSIOLOGY--CLONAL PROPAGATION OF FOREST TREES

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Clonal propagation.

4. Purpose: To develop economically feasible methods for clonal propagation of important forest-tree types.

5. Review of past work: The following factors have been found to exert a considerable influence on the rooting of cuttings of forest-tree species: (1) auxin treatment, (2) type of outdoor propagating bed, (3) age and position on tree from which cuttings are taken, and (4) clonal variation, ranging from 18 to 98 percent for red maple. Optimum conditions and treatments have resulted in the following rooting percentages: sugar maple--80%, red maple--70%, aspen--60%, white birch--50%, basswood--25%, and white pine--50%.

6. Accomplishments during past year: The variation in rooting ability of 16 red maple clones (one-half ♀ and one-half ♂) was from 8 percent to 94 percent; the males rooting to a greater extent, on an average, than the females. Treatment of greenwood cuttings with equivalent concentrations of indolebutyric, indolcacetic, and naphthaleneacetic acids indicated that the first chemical was best for red maple, while the last appeared best for sugar maple. (See Technical Note No. 46). By growing sugar maple cuttings in sash beds with horse manure below the rooting medium greenwood cuttings from old trees (60+ years) were rooted for the first time up to about 40 percent for cuttings of a current season's growth only, and 20 percent when older wood was present at the base of the cuttings. Over 3,000 white pine cuttings were treated and planted in three types of outdoor propagating beds; as white pine requires 2 years to root in outdoor beds, no data are available on rooting.

7. Plans for next year: Investigations will be continued on possible sex differences, effects of nutrition on rooting, and tests involving some of the vitamins. Observations will be continued on surviving cuttings in the 1941 beds.

8. Date of completion: Work with all genera used in breeding will probably not be completed until 1950.

9. Assignment: A. G. Snow, Jr.

RS-NE
GENETICS
Physiology

February 1, 1942

PHYSIOLOGY--REPRODUCTION IN FOREST TREES

1. Field division: Forest Management.

2. Work project: Forest Genetics.

3. Line project: Physiological aspects of reproduction in forest trees.

4. Purpose: To obtain information on the physiological phases of reproduction essential to research in heredity and variation.

5. Review of past work: Storage methods found suitable for red and white pine pollen have been applied with reasonable success to the storage of certain hardwood pollens and to spruce pollen.

6. Accomplishments during past year: Experiments on storage of hardwood pollen in inert gases and at reduced pressure have been set up, but not yet completed. Red and white pine pollen has been found more than 80 percent germinable after 30 months' and spruce pollen after 18 months' storage at 4° C. and 50 percent relative humidity.

7. Plans for next year: If personnel is available, work with hardwood pollens and gas storage will be continued.

8. Date of completion: Work with all genera used in breeding will probably not be completed until 1950.

9. Assignment: E. J. Schreiner, A. G. Snow, Jr. and J. W. Duffield.

RP-NE
TIMBER CONVERSION
Fuelwood Utilization

February 1, 1942

FUELWOOD UTILIZATION

1. Field division: Forest Products.

2. Work project: Timber Harvesting and Conversion.

3. Line project: Fuelwood utilization.

4. Purpose: To determine possible uses for low grade hardwoods as a source to the end that waste of such material is minimized and a return may be expected on material removed in silvicultural treatment.

5. Review of past work: The performance of a boiler in a Connecticut State institution using coal as fuel was analyzed, as a basis for comparison with hogged wood. Preliminary arrangements for hogging wood made but unable to obtain funds for installation of stoking and burning hogged wood.

Published results of tests of performance of charwood heaters in actual service which showed high efficiency and economy in operation, but need for changes in design to prevent smoking when refueled.

Completed large part of preliminary time studies on use of various tools, equipment and methods of crew organization in fuelwood production. Designed and tested equipment for hauling fuelwood in packages. Tests run on cost of hogging with sticks of various lengths.

Explored the use of wood gas by state institutions and obtained results showing could not compete with coal unless cost of producing wood reduced.

Cooperated in design and building of portable charcoal kilns.

6. Accomplishments during past year: Efforts to have equipment installed for stoking and burning hogged wood partially successful due to generous aid of a firm of consulting engineers who redrew designs and arranged for installation. The burner, inside and outside storage bins, and the hogging equipment are in place, but preference rating for conveyor, together with various controls not yet secured due to priorities. Funds for satisfactory completion of installation on hand through personal recommendation of Governor and generosity of Connecticut Forest and Park Association.

Results of costs studies for producing hogged wood published. Savings indicated, which may make it possible to hog wood at less than $1.00 per cord. Eight and 12 foot sticks more economical to handle than four foot sticks, but advantage may be more than offset by increased cost of splitting longer sticks. Size of feed spout on hog will determine size of sticks which can be accommodated and thus amount of splitting necessary. Preliminary production cost studies completed, including tests of a logging arch designed especially for cordwood. Arch not suitable for local conditions because too expensive and lacked maneuverability. Encouraging results obtained with use of U-shaped frames in cross-hauling full cord on and off a sled.

A power drag saw tested and found too slow for normal sizes of trees involved. Such saws can be used on trees, 20" dbh or more, where stove or fireplace length wood produced in first bucking operation. New type twisted wedge found little better than usual straight wedge and initial and maintenance costs much higher. Other power tools under observation but for present recommended practice is to fell trees up to 12" dbh with ax and pulp saw and use ax and two-man cross cut saw for larger trees, limbing and marking with ax. Buck within same diameter limits with same tools used in felling. Split with straight wedges and the Oregon pattern splitting maul. Pile only on sled when yarding. When possible to skid long lengths, bucking, splitting and piling should be done in a yard or at the roadside. Seasoning tests of oak cordwood completed and report in process. Portable charcoal kilns reported by Connecticut Agricultural Station in State Bulletin 448. Field headquarters moved to private company lands in northern Connecticut.

7. Plans for next year:

(1) Completion of installation of equipment for burning hogged wood at state institution.

(2) Supplement data on cost of producing and transporting hogged fuel.

(3) Continuation of time studies of fuelwood production and testing of new equipment.

(4) Service tests of two slow combustion wood heaters.

(5) Cost of production and yields on two 90-cord stationary charcoal kilns.

(6) Further studies of seasoning fuelwood and checking of weights in transportation.

8. Date of completion: Indefinite

9. Assignment: A. W. Bratton, in cooperation with state agencies in Connecticut.

RE-NE
FOREST SURVEY
Inventory

February 1, 1942

FOREST SURVEY

1. Field division: Forest Economics.

2. Work project: Survey of forest resources.

3. Line project: Cooperative technical supervision of an inventory and type map of forests in southwestern Maine.

4. Purpose: To insure adequacy of field methods in the CCC map and inventory of the white pine region of Maine. To apply results to such problems as silvicultural control of gypsy moth.

5. Review of past work: Between 1936 and 1938 crews working from four CCC camps completed an inventory and type map of 79 towns aggregating 1,890,000 acres. Types were mapped according to the classification of the Society of American Foresters. Inventory computations were not completed, but records have been organized for subsequent use.

6. Accomplishments during the past year: An article presenting a standard legend for the 96 forest cover types recognized by the Society of American Foresters for the eastern United States has been prepared for publication as an occasional paper. The forest types data has been summarized to evaluate present susceptibility of the forest to gypsy moth attack and to classify the area in priority for silvicultural control.

7. Plans for next year: Publish article on the opportunity for silvicultural control of the gypsy moth. Otherwise project will lie dormant.

8. Date of completion: 1942. Completed so far as possible with present resources.

9. Assignment: None.

RE-NE
FOREST SURVEY
Inventory

February 1, 1942

FOREST SURVEY

1. Field division: Forest Economics.

2. Work project: Survey of Forest Resources.

3. Line project: Inventory of a two million acre unit in central New York State.

4. Purpose: To obtain data on the forest resources in the selected unit and to test survey methods applicable to areas containing small holdings.

5. Review of past work: Project initiated October 1941.

6. Accomplishments during past year: The survey work is being carried on by men from Civilian Public Service Camp #12 at Cooperstown. Three field parties of 3 men each and an additional 3 men for office work are assigned to the project which is supervised by a technical man with survey experience. Plans were prepared and local volume tables compiled with aid of men from the Anthracite project and the Washington office.

Lines run four miles apart with survey plots taken every 8 chains are expected to give an accuracy of 95%. About half of the 2500 square mile unit was covered by the end of 1941. Computation has been kept up to date.

7. Plans for next year: The field work on the unit will be completed about March 1. Statistical summaries will then be prepared and published. On a portion of the original unit, additional field work will be done to give empirical indications as to whether and to what extent field work could be reduced. If arrangements for detached service can be made with Selective Service, and allotments to cover subsistence are made by the Forest Service, the survey will be extended to cover the entire state.

8. Date of completion: For inventory reports on Cooperstown unit, 1942.

9. Assignment: R. F. Ferguson.

RI-NE
STREAMFLOW

February 1, 1942

STREAMFLOW ON FORESTED WATERSHEDS

1. Field division: Forest Influences.

2. Work project: Water Behavior and Run-off.

3. Line project: Relation of forest and herbaceous cover to streamflow.

4. Purpose: To study the streamflow on small forested watersheds and the effect of changes in vegetative cover and land use practices.

5. Review of past work: At the Chenango Experimental Forest, a weir and stream-gauging station with two ground water measuring wells have been in operation since 1938. Four additional measuring wells were added in 1939, and a silting basin was constructed above the weir. Discharge measurements were made during low water stages for obtaining weir ratings. At the Hopkins Memorial Experimental Forest two weirs have been in operation since 1939 and construction has been under way on three additional installations.

6. Accomplishments during past year: Hydrologic and climatological measurements made at Chenango until October. Weir not rated. Hydrologic data continued at Hopkins on completed weirs and climatic records continued. Columbus type weir at No. 5 location not installed as CCC and other emergency labor not available.

7. Plans for next year: Minimum of measurements possible with depleted man power. Maintenance of weirs and weather records taken if possible.

8. Date of completion: Indefinite.

9. Assignment: R. F. Taylor.

RE-NE
FOREST COOPERATIVES
Cooperstown

February 1, 1942

COOPERATIVE MANAGEMENT AND MARKETING FOR FARM WOODLANDS

1. Field division: Forest Economics.

2. Work project: Forest Cooperatives.

3. Line project: Cooperative management and marketing for farm woodlands.

4. Purpose of work: To establish the basis for and evaluate the problems involved in cooperative management and marketing enterprises designed to rehabilitate and maintain the farm forest resource, restore and stabilize local forest industry, and afford woodland owners regular and more adequate income.

5. Review of past work: 1941 marked the beginning of the sixth year of the Otsego Forest Products Cooperative Association. Of the preceding five years, approximately two were spent in organization and in obtaining basic finances from local people and the Farm Security Administration. The remainder of the period was spent in constructing a modern processing plant for forest products, in developing membership for the Association, in inaugurating a program of forest management, in developing sales outlets and in solving various management and personnel problems. During this period membership reached over six hundred and more than three hundred different woodlot operations were carried on. About two million feet of logs of all grades and species were put through the plant.

During the entire period and for several months preceding the actual organization of the Association, the experiment station was actively engaged in studying basic problems and helping the Association in every possible way by bringing to it available or newly developed technical, business, and administrative aid. The station was particularly active in the woodland activities, and, in the process of developing specialized techniques for maintaining control of growing stock, was able to carry out all the work necessary in this field. In addition to studying carefully all phases of the Association activity, more general information on rural relief, farm management and the place of farm woodlands in rural economy was obtained. The station also supervised, for the Farm Security Administration, the loan made by that organization to the Association.

6. Accomplishments during past year: The station has continued to work with the Association as much as possible, and the accomplishments of the Association reflect to some degree the accomplishments of the station. During the year the number of members increased from 640 to 765. This latter is a net figure after losses due to death, sale of farm or dissatisfaction were deducted. The station prepared material for and participated in several indoor and outdoor membership meetings. It further helped prepare material for the Association monthly paper, the Otsego Forest Cooperator, which has elicited very favorable comments both locally and nationally.

The station continued its service of inventory and marking of timber for members. During the year about one million board feet of timber and nine thousand cords of fuel timber was marked for cutting. In addition, analyses were made of the total volumes of timber on 56 non-member holdings comprising 1120 acres. The timber appraisals have yielded data which is effective in educating farmers in conservative management principles. Simplified methods of checking compliance of cutting with marking were developed and applied on 75 holdings. These checks showed that there was almost universally compliance with the marking. They also gave additional data on converting factors for various types and conditions of timber.

The plant processed about three million board feet of logs. The station made studies of primary production and of hardwood dimension stock recovery using volunteer labor from the local Civilian Public Service camp. Much time was devoted to studying and systematizing log acquisition procedure and office management. As an aid in making financial statements, the station took eight monthly inventories of all stock on hand and worked up a system particularly adapted to this sort of business. A system for handling fuelwood stumpage sales through contractors was also devised.

Because of an unsatisfactory managerial situation the station, with aid from the Washington office, assumed direct responsibility for association activities for five months at the beginning of the year. Control was turned over to a new general manager in June.

During the year the number of directors was increased from 5 to 9 with arrangements for district representation.

For about half the year the Association operated a contract mill about thirty miles from the main plant as an experimental venture in giving service to members over a wider area. The results did not justify continuing this arrangement for a second season. However, the desire of farmers at greater distances for the services offered by the association, led to consideration of increasing the area served. This in turn raised questions as to available timber volumes, growth and drain. Consequently, through the labor and supervision available in the local Civilian Public Service Camp, a forest survey designed to cover an area of about two million acres centering around Cooperstown was inaugurated in October 1941. By the end of the year about half of the field work had been completed.

In the spring of 1941, the B.A.E. assigned two men to Cooperstown to carry on a study of forest management in relation to other farming business. Detailed analyses were made of the activities of 90 association members. The station participated in the study, advising on the set-up and actually working out the technical forestry aspects.

The project, as in past years received large numbers of visitors, including groups from forest schools, technical foresters from various Federal and State agencies, as well as cooperative experts. In November the Northeastern Forest Research Advisory Council met at Cooperstown and spent two days going over the project. The educational value of the project was further evidenced by prominent articles in several periodicals and newspapers circulating in New York State.

7. Plans for next year: The plans for the coming year are clouded because the impact of the war on both project and personnel is as yet indeterminable. Undoubtedly it will be necessary to spend considerable time in giving training to men recruited to replace those called to the service. Special jobs in connection with census work, War Boards and Planning Committees will preempt time of station personnel. However, in addition to continued close and active cooperation with the association to maintain the flow of logs, reduce costs of operation, improve utilization and strengthen forestry practice, it is planned to carry on the woodland service work for association members, as heretofore, and to give considerable time to analyzing the results of activities to date, and to complete reports for publication. Cooperation with the B.A.E. will be continued to the end that the report on the farm survey may reflect adequately the experience of the association. Particular emphasis will be given to the educational phases of the program.

8. Date of completion: Indefinite.

9. Assignment: C. R. Lockard, D. E. Rulison.

RE-NE
FARM FORESTRY
New York

February 1, 1942

FARM CONSUMPTION AND OUTLETS FOR FARM FOREST PRODUCTS

1. Field division: Forest Economics.

2. Work project: Financial Aspects.

3. Line project: Farm Forestry - Farm Consumption and Outlets.

4. Purpose of work: To determine for a given economic unit the use made of farm woodlands by operating farmers and the factors influencing that use.

5. Review of past work: This work was initiated in 1940, under policies established by a Memorandum of Agreement between the Forest Service, the New York State Agricultural Experiment Station, New York State College of Forestry and the New York State Conservation Department. Detailed information was obtained on 111 farms representing 1/4 of the operated farms in a forest unit in Essex and Warren counties centering around Crown Point, New York. In addition to the farm information data were collected on forest land ownership and on 112 forest products markets available to producers within the unit. The information collected was worked up into a preliminary report which was distributed to the cooperating agencies in December 1940.

6. Accomplishments during past year: To make results representative of the entire white pine region of New York State twenty-two additional farm records were obtained from Clinton County. When funds ran out in April the project leader was dropped. The final report has not yet been put into shape for publication.

7. Plans for next year: Time from other Forest Economics work will be contributed to complete the project report for publication.

8. Date of completion: 1942.

9. Assignment: C. R. Lockard.